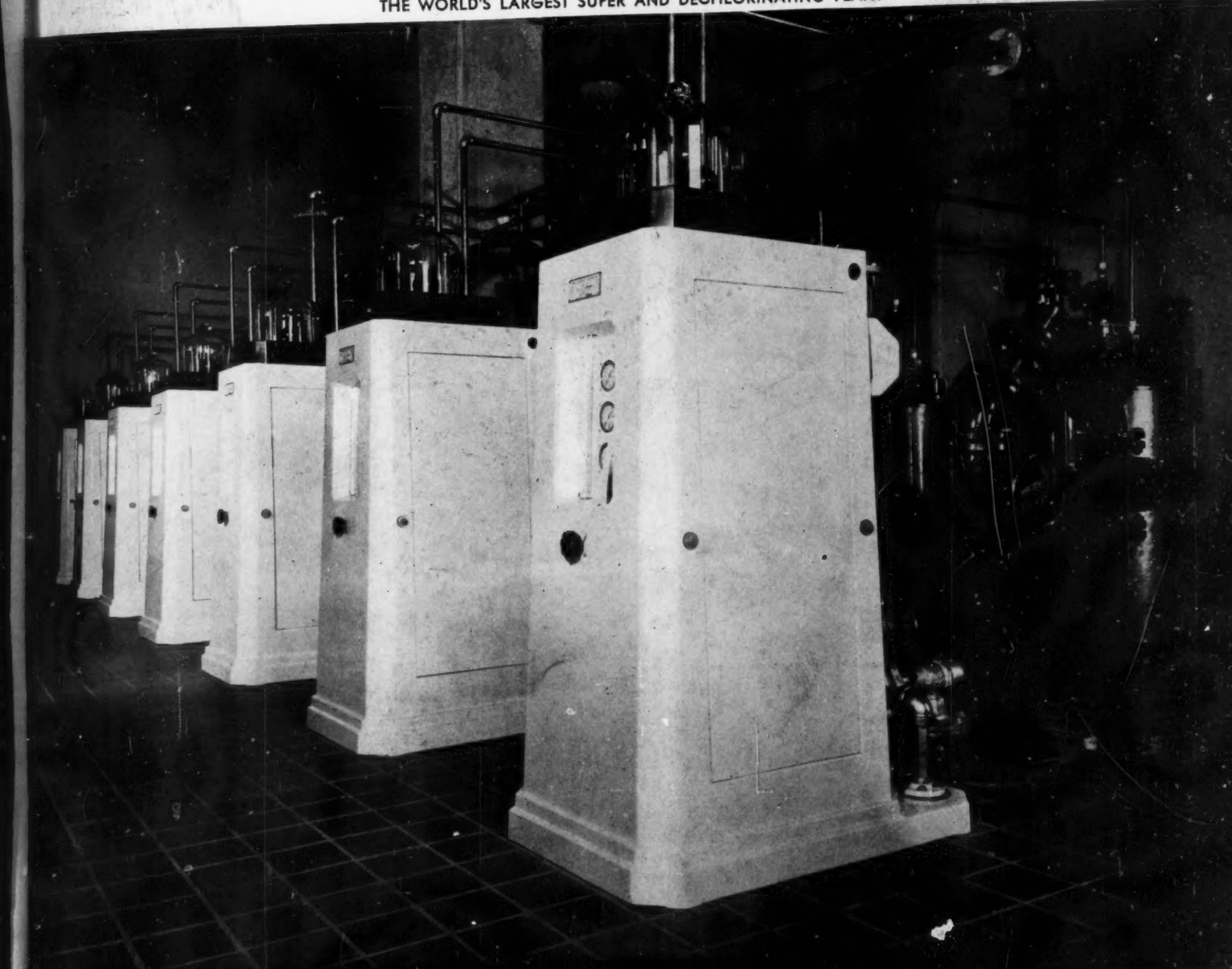
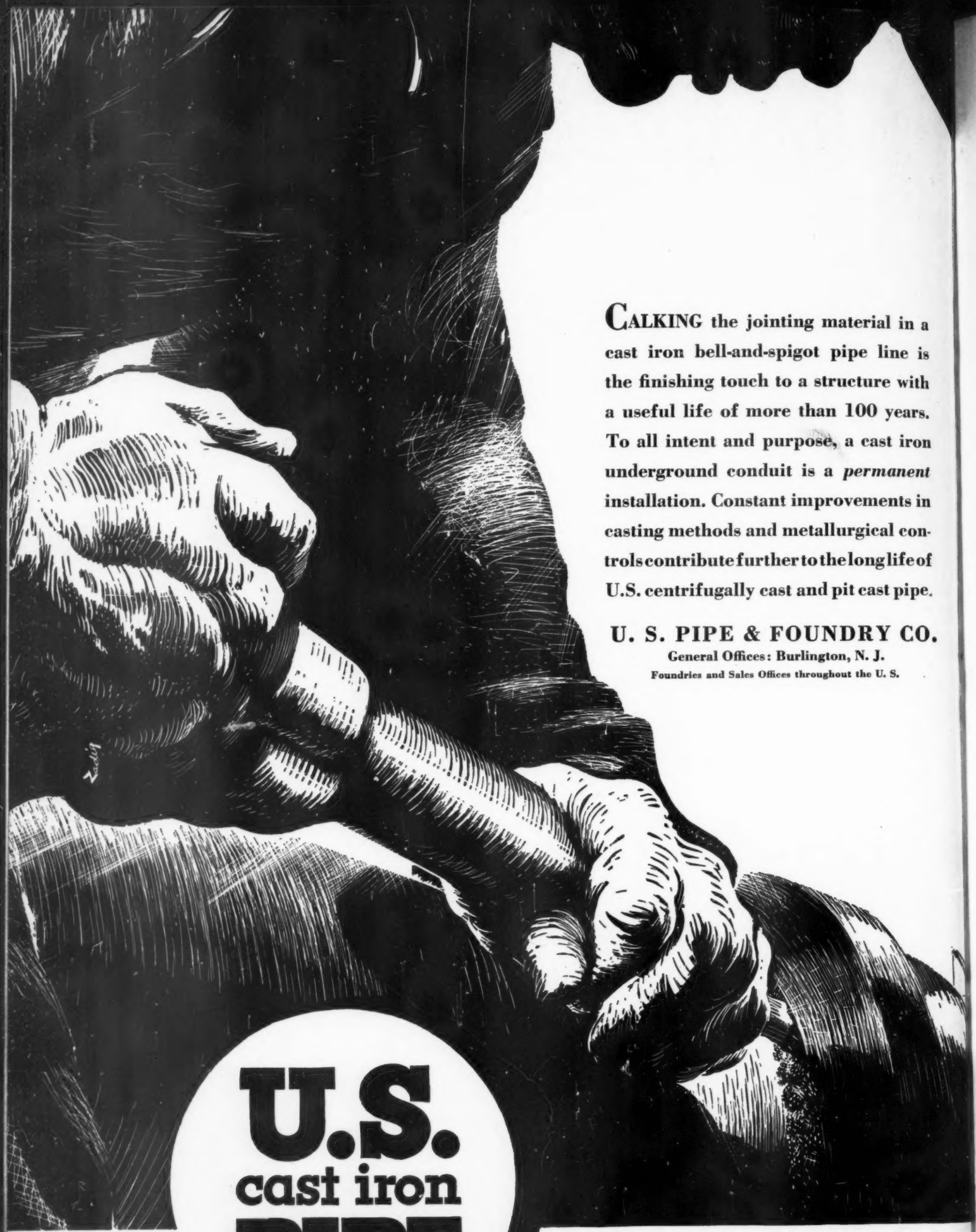
WATER WORKS & SEWERAGE

HBP ABC

AT TORONTO
THE WORLD'S LARGEST SUPER AND DECHLORINATING PLANT





CALKING the jointing material in a cast iron bell-and-spigot pipe line is the finishing touch to a structure with a useful life of more than 100 years. To all intent and purpose, a cast iron underground conduit is a *permanent* installation. Constant improvements in casting methods and metallurgical controls contribute further to the long life of U.S. centrifugally cast and pit cast pipe.

U. S. PIPE & FOUNDRY CO.

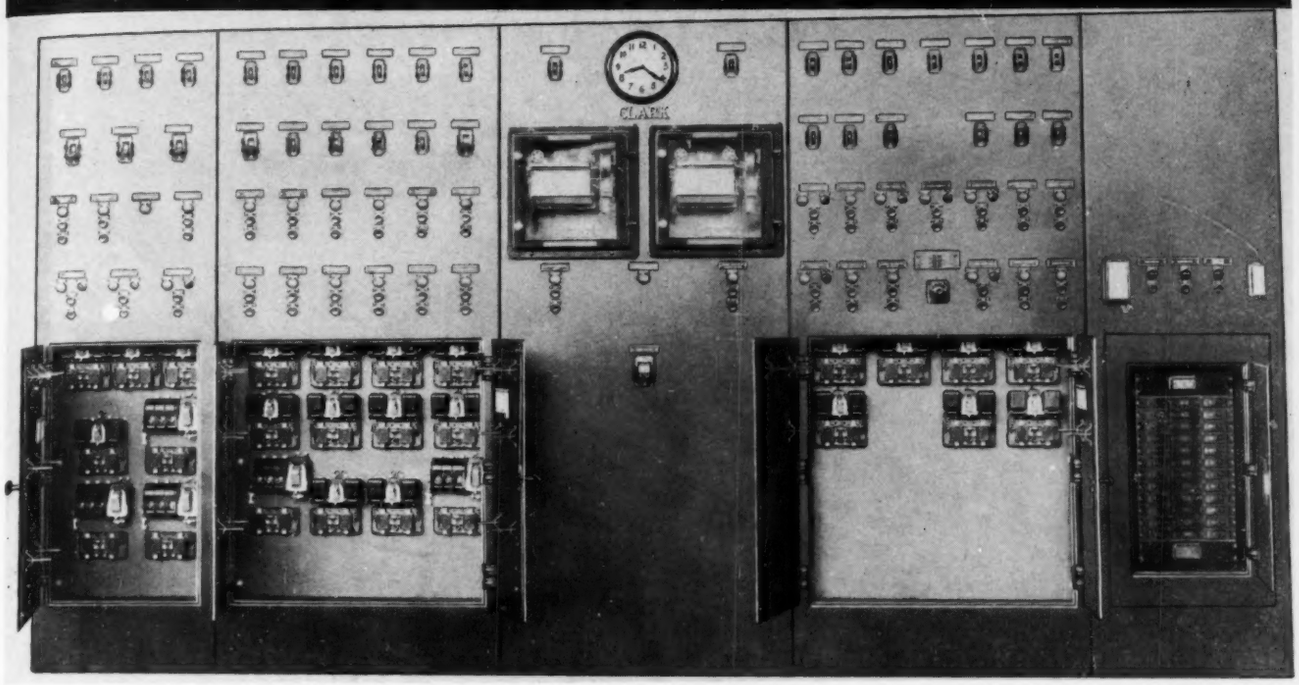
General Offices: Burlington, N. J.

Foundries and Sales Offices throughout the U. S.

U.S. cast iron PIPE

for water works, gas, sewerage, drainage and industrial services.

26 Motors Clark Controlled



¶ This Main Station, 5 Panel Board erected in an Eastern Sewage Treatment Plant provides adequate protection and control for 26 motors, ranging from ¼ hp. to 70 hp.

¶ These motors operate Draft Fans, Compressors, Filters, Vacuum Pumps, Sludge Pumps, Agitator Pumps, and Chemical Treatment Pumps. A 70 hp. Crane motor is also controlled from this board.

¶ Each motor starting unit is equipped with Disconnect Circuit Breaker, Across-the-line Starter with Overload Protection, and with the necessary Push Button Stations, Selector Switches, and Indicating Lights in accordance with the use and/or operation of the starter.

¶ This is a completely Dead Front, Sheet Steel Enclosed, Cubicle Type Control Panel, with all Indicating Lights, Push Buttons, and similar accessories flush mounted.

¶ A 24 Circuit Lighting Panel, Electric Clock, and Recording Meters also are flush mounted, but doors in the lower part of the panels provide easy access to all starting equipment.

¶ Such an installation provides the maximum safety, not only to equipment, but prevents tampering by unauthorized persons.

¶ "3C" Engineers will gladly consult with you on Water Works and Sewage Treatment Plant Electrical Control Problems—

OFFICES IN PRINCIPAL CITIES

THE CLARK CONTROLLER CO.

1146 EAST 152ND ST. CLEVELAND, OHIO

WATER WORKS & SEWERAGE, January, 1941. Volume 88. Number 1. Published monthly at 330 South Wells Street, Chicago, Ill., by the Gillette Publishing Company. Per copy, 25c. Subscription rate, United States $2.00 per year; Canada $2.40 per year; Foreign $3.00 per year. Copyright, 1941. Entered as Second Class Matter, June 2, 1931, at the Post Office at Chicago, Ill., under Act of March 3, 1879.

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Our specially designed fractionating column removes 95% of the residual impurities from Pennsylvania Salt Liquid Chlorine. There's no more hexachloroethane, hexachlorobenzene, or hexachloroacetylene—the taffy is gone. We've taken the "hex" out of your chlorination.

And this more highly refined chlorine comes to you in safe, clean containers, each fitted with a newly reconditioned and repacked valve, each check tested before and after loading, to insure delivery of this better chlorine to you in an extra safe, acceptable condition.

20 important suggestions helpful to you and your employees are contained in our safety wall placard "Handling Liquid Chlorine." Write today for a free copy to hang near your chlorinator.

PENNSYLVANIA SALT MANUFACTURING COMPANY

Chemicals

They Lock 'em and Leave 'em!

These small stations, dotted around Wayne County, Michigan, are important links in a sewage disposal system. Housing pumps and primary settling tanks, they are automatic in operation and unattended, thanks to dependable equipment.

With an eye to making these buildings equally self-sufficient, Aluminum windows and some Aluminum doors were installed. They need no protective coatings of paint to preserve them. There's no rusting or rotting to require expensive replacements of parts. They are weather-tight and secure, yet are always easy to open and close. They add to the attractiveness of these buildings.

Aluminum paint, adding its "coat of metal protection" to equipment and other metals, likewise helps to lengthen the time between visits of maintenance men.

Small plant or large, you'll find these Alcoa Aluminum products helping to effect similar economies in operation and maintenance.

ALUMINUM COMPANY OF AMERICA, 1955 Gulf Building, Pittsburgh, Pennsylvania.

DEFENSE COMES FIRST

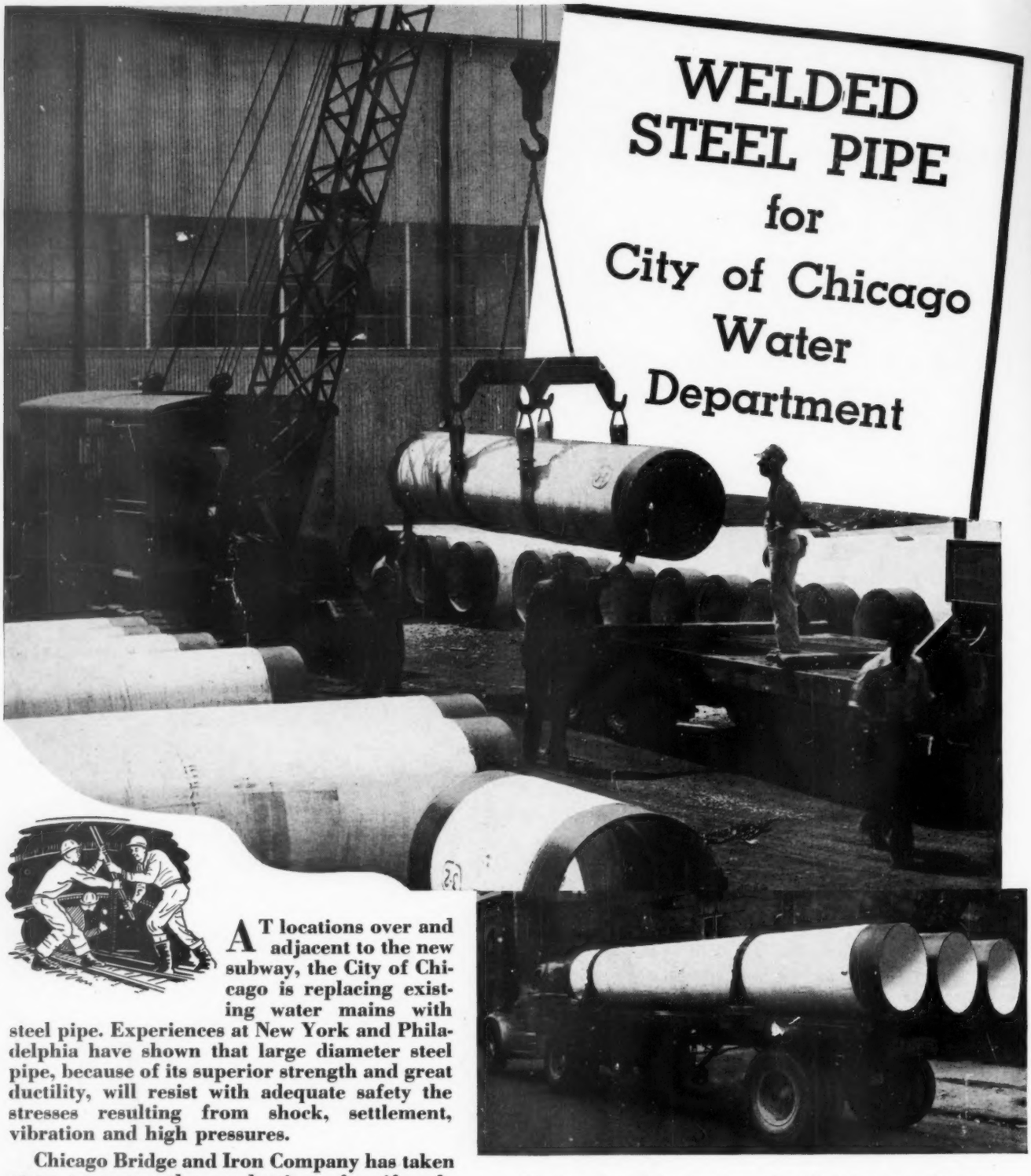
To meet the needs of the National Defense Program, plus the normal demands of peace, a vast expansion of our already greatly increased production capacity is being speeded. When the emergency is past, there will be more Aluminum available than ever before.

Meanwhile, if you can't get all the Aluminum you want when you went it, remember Aluminum is helping you by helping to meet the National emergency.

ALCOA

ALUMINUM

ALCOA ALUMINUM



AT locations over and adjacent to the new subway, the City of Chicago is replacing existing water mains with steel pipe. Experiences at New York and Philadelphia have shown that large diameter steel pipe, because of its superior strength and great ductility, will resist with adequate safety the stresses resulting from shock, settlement, vibration and high pressures.

Chicago Bridge and Iron Company has taken steps to assure the production of uniformly high quality welded steel pipe, designed to meet strict requirements. For complete information or quotations, write nearest office.

The top view shows sections of welded steel pipe being loaded for delivery to the City of Chicago. Directly above are three pipe sections en route to the job.

CHICAGO BRIDGE & IRON COMPANY

Chicago	2198 McCormick Bldg.	Birmingham	1586 North 50th Street	Philadelphia	1644-1700 Walnut St.
New York	3390-165 Broadway Bldg.	Tulsa	1646 Hunt Bldg.	Boston	1548 Consolidated Gas Bldg.
Cleveland	2262 Builder's Exchange	Houston	918 Richmond Avenue	San Francisco	1083 Rialto Bldg.
Dallas	1679 Praetorian Bldg.	Detroit	1551 Lafayette Bldg.	Los Angeles	1455 Wm. Fox Bldg.

Plants at **BIRMINGHAM, CHICAGO, and GREENVILLE, PA.** *In Canada:* **HORTON STEEL WORKS, LIMITED, FORT ERIE, ONT.**

They "Ghosted" This Sewer Line!

It slipped under the road with the greatest of ease. The broken arrow shows where an ARMCO Sewer crossed this main thoroughfare without interrupting traffic. Officials were so pleased with the savings in time, money and inconvenience that they again chose ARMCO Pipe for a similar job indicated by the solid arrow.

It happened during the busy holiday season with the temperature 14° below zero. This new ARMCO storm sewer was laid under a main thoroughfare in a midwestern city and traffic never knew the difference.

In reality no phantom job, the 54-inch ARMCO Asbestos-Bonded Pipe was jacked 70 feet under the street without disturbing the surface. The work *required only 80 hours* compared to an estimated 4 weeks by the open trench method. Traffic moved along without interruption and the extra expense of trenching, backfilling and repaving the street was eliminated.

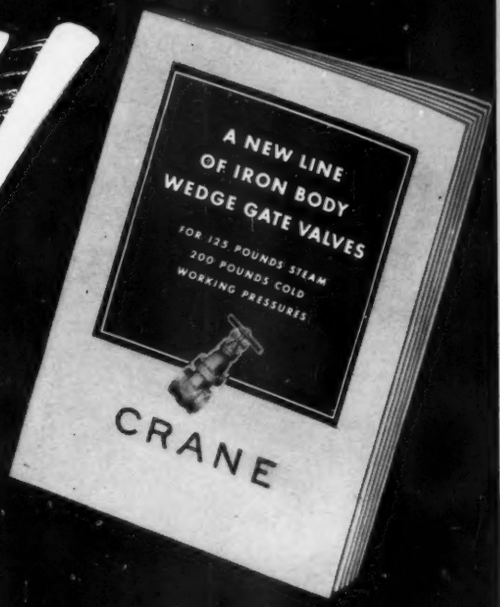
Yet ARMCO Asbestos-Bonded Pipe offers many other benefits. The flexible corrugated design prevents breakage, and band couplers make for strong, tight joints. Longer lengths and fewer joints mean lower installation costs. Cradling is unnecessary. Corrosion is stopped dead by a full bituminous coating tightly bonded to the Galvanized ARMCO Ingot Iron. And for utmost durability a thick bituminous pavement will check erosion—make the bottom last as long as the top.

Many major cities have benefited by using ARMCO Asbestos-Bonded Pipe. Yours can too. Try it on that next sewer job. Your request will bring prices and full information promptly. ARMCO DRAINAGE PRODUCTS ASSOCIATION, 506 Curtis Street, Middletown, Ohio.

ASBESTOS-BONDED

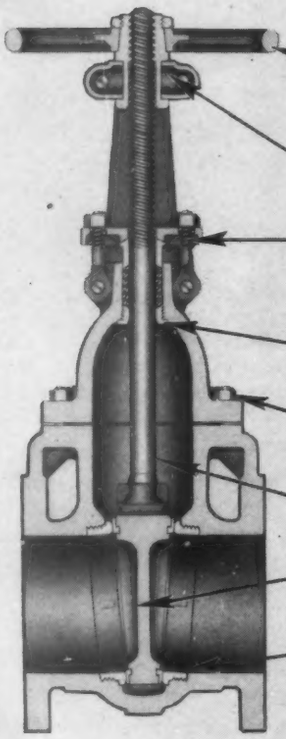
ARMCO SEWER PIPE

FLASH!



A new and complete line of Crane Iron Body Wedge Gate Valves for 125 pounds steam, 200 pounds cold working pressures. No increase in price. Improved design features extend adaptability for service and assure long trouble-free life under severest conditions. Complete specifications in catalog available from your Crane Representative or by mail request.

NEW FEATURES LIKE THESE IN ALL PATTERNS



Unbreakable malleable iron handwheel.

Easy lubrication fitting in yoke sleeve.

Malleable iron ball-type gland flange with swing eye bolts.

Renewable shoulder-type stem hole bushing.

More bolts of smaller diameter in body-bonnet joint.

Full length "V-section" disc guides.

Solid web-type disc with tee-head stem connection.

Straight through ports. Renewable seat rings.

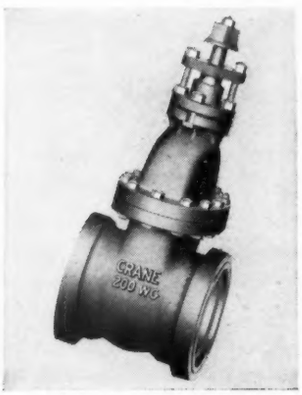
Brass trimmed or All-Iron

OUTSIDE SCREW AND YOKE
Screwed and flanged ends. Also in alloy cast iron, flanged ends

INSIDE SCREW, NON-RISING STEM
Screwed, flanged, hub ends

MARINE CARGO SYSTEM VALVES
Flanged ends

QUICK-OPENING TYPE
Screwed and flanged ends



INSIDE SCREW, NON-RISING STEM
with Hub ends—for Water Works

CRANE

CRANE CO., GENERAL OFFICES:
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VALVES • FITTINGS • PIPE
PLUMBING • HEATING • PUMPS

NATION-WIDE SERVICE THROUGH BRANCHES AND WHOLESALERS IN ALL MARKETS

Can we improve on Nature? Certainly not on the beauty of a magnificent waterfall!

But since "raw" water frequently must be treated to make it suitable for our use, engineering skill is called upon to assist Nature by correcting various conditions.

For water treatment, DIAMOND LIQUID CHLORINE is the first choice of municipal engineers everywhere, because they know that DIAMOND Liquid Chlorine is uniformly pure and absolutely dependable. Standardize on DIAMOND Liquid Chlorine and you will always have the best!

DIAMOND ALKALI COMPANY Pittsburgh, Pa., and Everywhere

Engineers may design . . .

BUT FEAR BLOCKS THE WAY

BIGVILLE — and many another thriving community, for that matter — has it's kindly old MR. YES, BUT among the City Fathers or engineers. Let someone offer a new and better way to do a thing; advocate a progressive idea, and he's in his glory. For squelching things he uses a very neat technique. No matter how clean cut, far-reaching and advantageous a move might be, you can count upon him to block it, by parading a lot of fears that start with "YES, BUT".

No City Father, Commissioner or Engineer need fear the adoption of designs or equipment for the sanitary disposal of municipal solid wastes, including sewage sludge, screenings, grit, garbage, rubbish or industrial wastes offered by this organization. For "Incineration Headquarters" maintains an integrated program of laboratory and field research. The coordination of laboratory research, plant design, operation and field experience makes it possible for this organization to offer only tried and proven equipment of the most advanced design. There's no reason why you and your community should accept an outmoded practice, just because that's the way they do it over in So and So. Progress has been made in the science of incineration as in road building, as in lighting, as in municipal management itself. What's good enough for some other place may not meet your local needs at all.

So if your community has a waste disposal problem, get in touch with "Incineration Headquarters". You will secure the benefit of the knowledge, experience, resources and cooperation of the best equipped organization in America to solve these problems.

NICHOLS
ENGINEERING & RESEARCH CORPORATION

60 WALL TOWER BLDG., NEW YORK, N. Y. NERCO *UNIVERSITY TOWER BLDG., MONTREAL, P. Q.*

Better specify MATHEWS BECAUSE IT'S WINTERPROOFED

"HERE." See how the operating threads are sealed away from inside water by a stuffing box —and from outside rain and spray by the roof-like shield operating nut. Threads or revolving nuts can't freeze up because they don't get wet.

"AND HERE." This is where the outer protection case is free to rise when grabbed by frost-heaved ground. The water-carrying parts are never strained, never cracked or started at the elbow.

"AND HERE." This is where the entire barrel, including all working parts, screws into the elbow so it can be changed in a jiffy, just like changing a tire. No digging is necessary. Write for full description or prices.

MATHEWS HYDRANTS

Made by R. D. WOOD COMPANY

Manufacturers of Sand Spun Pipe (centrifugally cast in sand molds) and R. D. Wood heavy-duty gate valves for water works

400 CHESTNUT STREET, PHILADELPHIA, PA.

HTH Saves the Day!

With Emergency Chlorination Job For Rochester, N.Y.

Street flushing tank preparing HTH solution to be injected into hydrants by auxiliary pumper.

Wm. H. Roberts, Commissioner of Public Works, Rochester, N. Y. writes—

"Following the accidental introduction of impure river water into our city drinking water mains on December 10th and 11th, we discovered the contamination was so widespread that regular chlorination at our reservoirs would take considerable time.

"We made direct injections of HTH solutions into the mains at many points of the City by using our regular equipment. Each crew consisted of a street flushing tank and an auxiliary pumper.

"Five pounds of HTH were added to each 2,500-gallon tank of water and pumped back into the mains through the fire hydrants.

"We believe this method of chlorination with HTH solutions enabled us to save two weeks time in purifying our drinking water system."

● River water (four million gallons of it!) accidentally enters the drinking water system at Rochester, N.Y. Liquid chlorine is added at the reservoirs but does not reach the dead ends of a drinking water system with 500 miles of mains. It is decided to use hypo-chlorination to speed up purification of the drinking water, and an emergency shipment of Sanitation HTH is rushed to the scene.

Flushing trucks of 2,500-gallon capacity speed to hydrants at strategic points in the city and auxiliary pumpers inject solutions of HTH into the hydrants. The solution is approximately 168 p.p.m. available chlorine. The operation is started about 4:30 P.M. December 15, and on the evening of the next day the drinking water is declared pure. Says Wm. H. Roberts, Commissioner of Public Works, Rochester —*"We believe this method of chlorination with HTH solutions enabled us to save two weeks time . . ."*

Once again—HTH saves the day—proves its value as a standby source of chlorine. Proves why hundreds of water works throughout the country rely on Sanitation HTH not only for quick, efficient service when emergencies arise but also for many everyday sanitation jobs. Be Prepared With Mathieson HTH. It contains 70% available chlorine, is quick acting, easily soluble, easily transported. Write or wire for full information and your nearest source of supply.

HTH comes in 5-lb. cans with replaceable caps, packed 9 cans to the case; also in 100-lb. drums.

THE Mathieson Alkali Works (INC)

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LIQUID CHLORINE . . . HTH . . . SODA ASH . . . CAUSTIC SODA . . . BLEACHING POWDER . . . BICARBONATE OF SODA . . . AMMONIA, ANHYDROUS and AQUA . . . PH-PLUS (FUSED ALKALI) . . . DRY ICE . . . CARBONIC GAS

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Factors responsible for the trend to STEEL WATER LINES...
1. High Strength. Withstands high pressures, heavy trench loads, vibrations, shocks, washouts, water hammer and other emergency stresses.
2. Long Lengths. Fewer joints per mile, faster laying, less damage to pavement, lower water loss.
3. Light Weight. Saves freight and trucking charges. Speeds laying. Cuts laying costs.
4. Shatterproof. Eliminates sudden ruptures in case of fire and emergencies. Reduces property damage.
5. Smooth Surface. Ideal for linings or coatings, where necessary. Greater carrying capacity.
6. Long Service. Sixty-year old installations still in service.

HERE'S PROTECTION *for the City of Asheboro, N. C., for years to come. This installation calls for 6,000 ft. 12¾"O.D.,* NATIONAL *Line Pipe. The* NATIONAL *Steel Pipe supplied here had to meet particular requirements of the local water works engineer—another example of National's service.*

STEEL PIPE is the only water line material that gives you all these features. And remember, you can bend it, twist it, and even flatten it; but unlike frangible materials, it will not break or shatter. NATIONAL Steel Pipe has proved, beyond a doubt, its dependability and that is why it is being specified by the country's leading water works engineers and superintendents. NATIONAL is made in accordance with A.W.W.A. Specifications.

There are many factors which interfere with the operation of a water system that you can't control, such as earth settlement, traffic vibration, tuberculation and corrosion. *But* you can minimize them to a controllable degree if you specify NATIONAL Steel Pipe! It will give you the most service per dollar of cost—the greatest safety and freedom from trouble that money can buy. Write today for Bulletin 21, complete information on NATIONAL Steel Pipe for underground water lines.

NATIONAL TUBE COMPANY

PITTSBURGH, PA.

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UNITED STATES STEEL

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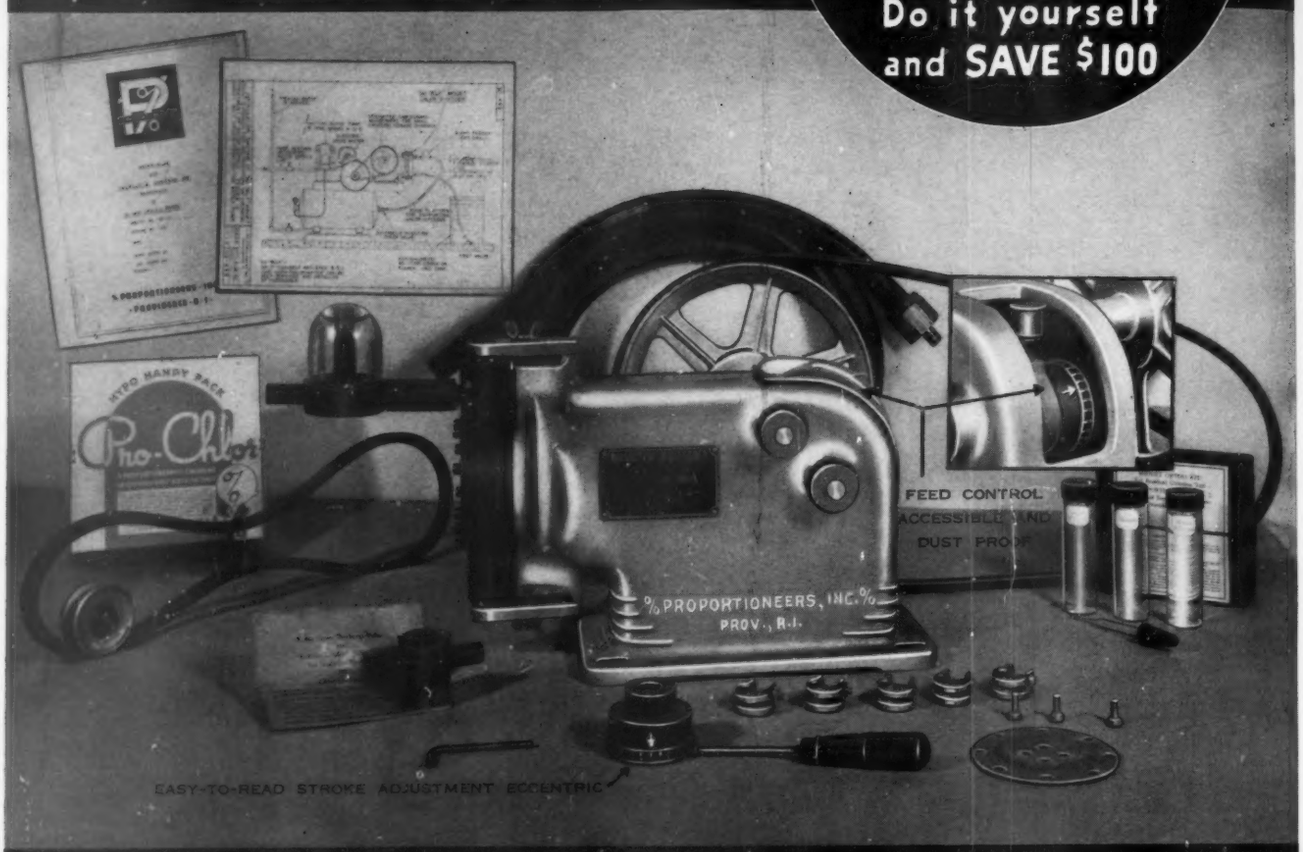
SHIPPING WT. 60 LBS. COMPLETE
Do it yourself and SAVE $100



CHLOR-O-FEEDER

COMPLETE
as illustrated

Nothing else to buy!! Complete, as illustrated, with Instruction book — Hypo Handy Pack of chlorine powder—Water Testing Kit—Hose and Clamps—Sight Feeder—Spare Diaphragm and parts for a year's replacement service, tools, belts, pulleys, and all parts for installing.

for Flows Under 25 Gallons per Minute and Pressures Under 75 Pounds, Please

%Proportioneers, Inc.% led the way to low-cost hypo-chlorination seven years ago with the now famous Midget Chlor-O-Feeder which first brought chlorine treatment within the budget of small communities. Now, with hundreds of Du-Self Chlor-O-Feeders in actual operation, we release for general sale this new DU-SELF which brings the protection of sterilized water to even the tiniest water supply—camp, resort, roadside stand, or private home!

Du-Self is sold only as a complete standard package, guaranteed by us, all ready for installation which is so simple that ingenious purchasers can "do-it-yourself" or, the local plumber, handy man, or garage mechanic who services water pumping systems, can help.

Thank you, friends!

%Proportioneers, Inc.% realizes that the Du-Self will not replace the Heavy Duty Midget for water works service; this advertisement is published with the hope that our friends will be willing to recommend the Du-Self to people who are faced with a problem it will handle!

%PROPORTIONEERS, INC.%

CHEMICAL FEEDER HEADQUARTERS
9 N. Codding St. Providence, R. I.

WATER WORKS & SEWERAGE

PUBLICATION OFFICE
330 South Wells Street, Chicago, Ill.
E. S. Gillette, Publisher

EDITORIAL OFFICE
155 East 44th Street, New York, N. Y.
L. H. Enslow, Editor

COMING!

"Developments and Trends in Sewerage Practices and the Treatment of Sewage and Industrial Wastes"

Constitutes the annual review of progress in sewerage practices, and sewage and industrial waste treatment, to be featured in February. Again we have been most fortunate in the reviewer. He is chairman of the National Water Resources Committee, and a writer-extraordinary who needs no further introduction than to say that he is—

DR. ABEL WOLMAN,
Professor of Sanitary Engineering,
Johns Hopkins University

"Youth Studies Water Supply and Sewage Disposal"

Are two interesting brief articles which reveal what the members of a National organization, comprising the younger generation, learned upon looking-in on the water supply and sewage disposal facilities of their communities. The "Camp Fire Girls" organization has encouraged its member groups to make a study of their local public utilities. As a result, their impressions, and recommendations for improvement (and this is the interesting feature of these reports) have been put into story form at our request. This movement to get the on-coming citizens interested in their public utilities has significance of import, and their impressions make interesting reading. The author—

NANCY WALKER,
"Camp Fire Girls," Inc.,
New York City

"Lining Water Mains in Place"

Is an account of another satisfactory experience, and the observed beneficial effects and results, from cleaning and cement-lining water mains in place by the Tate Process. Every time a new job of lining pipes in place with cement mortar is done new things are learned. The experiences and results at Danvers, Mass., will be told by—

ROGER W. ESTY, Superintendent,
Danvers Water Department

"What Constitutes Warranty on the Part of the Well Driller"

Is a review of a concrete case before the courts, which cites the court's reasoning in holding that the well drilling contractor had failed to meet an *implied* warranty or guarantee of satisfactory water. In persuading the defendant to approve of deeper drilling and extra expense the Appellate Court held that warranty had been implied although never put into written form. The story contains some neat considerations for those entering into well drilling contracts. The author—

LESLIE CHILDS,
Indianapolis, Ind.

"Superchlorination and Dechlorination at Richmond"

Is another story which relates success with this method of vastly improving water quality, while concurrently assuring super-safe production. Fact is, Richmond, Va., has practiced superchlorination of its raw water for some years. Now, with simple sulphur dioxide dechlorination at the filters, a further improvement is reported. Dosage control has been vastly simplified and constancy of results demonstrated. The paper is written by—

M. C. SMITH, Chief Engineer,
and
H. E. LORDLEY, Plant Sup't,
Dep't of Utilities, Richmond, Va.

"A Quick, Simple Method of Determining Solids in Sewage Sludges"

Is that developed at the Buffalo Sewage Treatment Works. It should be a marked help to operators wishing to determine with a fair degree of accuracy the solids content of sludges. The scheme involves centrifuging samples and applying a factor to convert % solids by volume to % by weight. The authors—

DR. GEO. E. SYMONS, Chief Chemist,
and
WM. L. TORREY, Ass't Chemist,
Buffalo Sewer Authority, Buffalo, N. Y.

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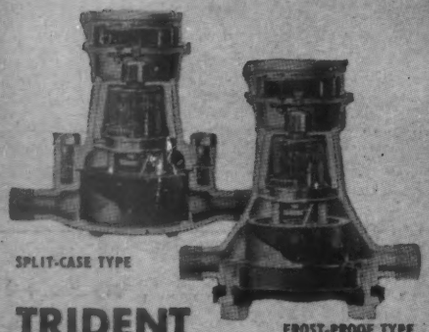

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WATER WORKS & SEWERAGE

VOL. 88, NO. 1 *A Gillette Publication* JANUARY, 1941

PROGRESS OF THE YEAR IN WATER SUPPLY AND PURIFICATION

A Review of Developments and Trends of 1940

By NORMAN J. HOWARD*
President of the American Water Works Association

The Author

WITH the tragic situation existing in Europe, little new information dealing with the construction of new works, improvements in technique or changes in water purification methods has emanated from that source. Doubtless after the war the outcome of research projects which are being maintained, at least in Great Britain, will be made available. Regardless of the rapid expansion of water purification in America, new contributions to the art and science of treatment have been comparatively few. Researches carried out during the year resulted in the elucidation and extension of information upon certain problems, chiefly those associated with corrosion and taste and odor. Several plants of considerable size were commenced or completed during the year; and, in reviewing the salient points of such plants, one is struck by the following features: The increasing use of improved methods of flocculation; changes in types of filter bottoms, notably the general reintroduction of the Wheeler filter bottom; increased size of filter medium; improved filter washing, involving jetting for sand scour; chemical methods for the control of corrosion, and prevention of after-precipitation and red water; and improved methods for the prevention of taste and odor.

*Director of Water Purification, Toronto, Ontario.

Betterment of Raw Water Quality

What must be regarded as of vital importance to water supply was the increased interest taken in the control and prevention of water pollution. During the year the U. S. Congress approved of two interstate compacts aimed at the reduction of pollution in the Ohio

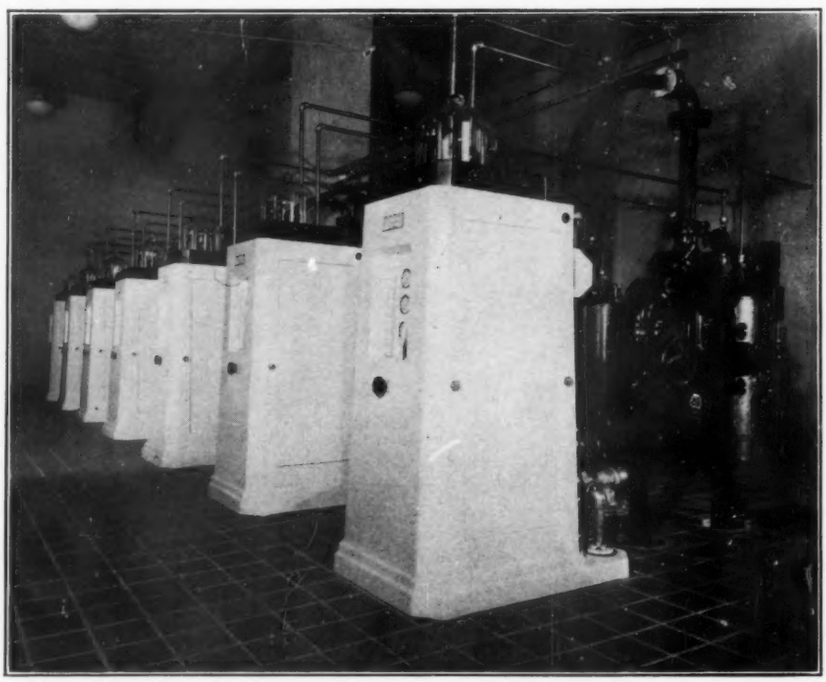
THE NO. 1 SOFTENING AND FILTRATION PLANT OF THE YEAR
The plant of the Metropolitan Water District of Southern California is rapidly taking form.

OPERATING GALLERY OF TORONTO'S NEW VICTORIA PARK FILTER PLANT

River and the Potomac River. These represent the first anti-pollution covenants ever to receive Congressional approval. The covenant gives widespread powers to the States and Districts involved and will do much to speed up early construction of treatment works to control the indiscriminate discharge of trade waste, and in general to further reduce the pollution load that many water systems are now called upon to handle. As an example of what can be done in reduction of stream pollution can be cited the work carried out by the city of Buffalo in abating pollution of the Niagara River. Dr. G. E. Symons published his second report on this question during the year and showed that through sedimentation and chlorination the coliform group of bacteria were reduced by 97 per cent in the river water below the disposal plant. At Toronto, a new disposal plant has been approved and will shortly be erected at a cost of $5,500,000. The treatment will be very similar to that employed at Buffalo; and, with chlorination, marked reduction of the bacterial pollution of Lake Ontario should result. Within the past few years several large cities have been forced to secure new sources of water supply as a result of excessive trade waste and sewage pollution. Any legislative action which will result in improvement in quality of the raw water supplies will be welcomed particularly by those who have major purification problems on their hands.

Supply Projects and Purification Plants of the Year

The new water purification project at Toronto was completed early last spring at a cost of over $14,000,000. This plant provides a 55 million gallon covered water storage reservoir, a 9 mile underground water conduit located along the water front approximately 120 feet below surface, a raw water intake designed for an ultimate capacity of 200 million gallons per day, and a modern rapid sand plant having a capacity of 100 million gallons daily. Pneumatic conveyors are provided for unloading chemicals. Alum will be applied immediately ahead of the pumps and the water then flows to a spiral mixing system consisting of six circular chambers permitting a 30-minute mixing period. The water enters the first compartment and is discharged at the bottom into the second chamber, circulating in a spiral manner to the top of this compartment and passing in like manner through the other four compartments. Other mixing systems of this type are in successful use at Ottawa and Niagara Falls, Ont. From three to four hours' retention in the clarification basin is given prior to entry on the filters. There are 20 filters of the standard rapid sand type, each with a rated capacity of 5 million gallons per day. The sand has an effective size of 0.5 mm. with a uniformity coefficient of 2.0. The filters are glassed in to prevent condensation inside the building and to conserve heat in the winter months. Provision is made for the use of activated carbon and super and de-chlorination, equipment for the latter treatment being the largest and most up-to-date in the world. The filtration plant was tuned up in May last and is now ready to be placed in operation at any time. It is only being kept out of

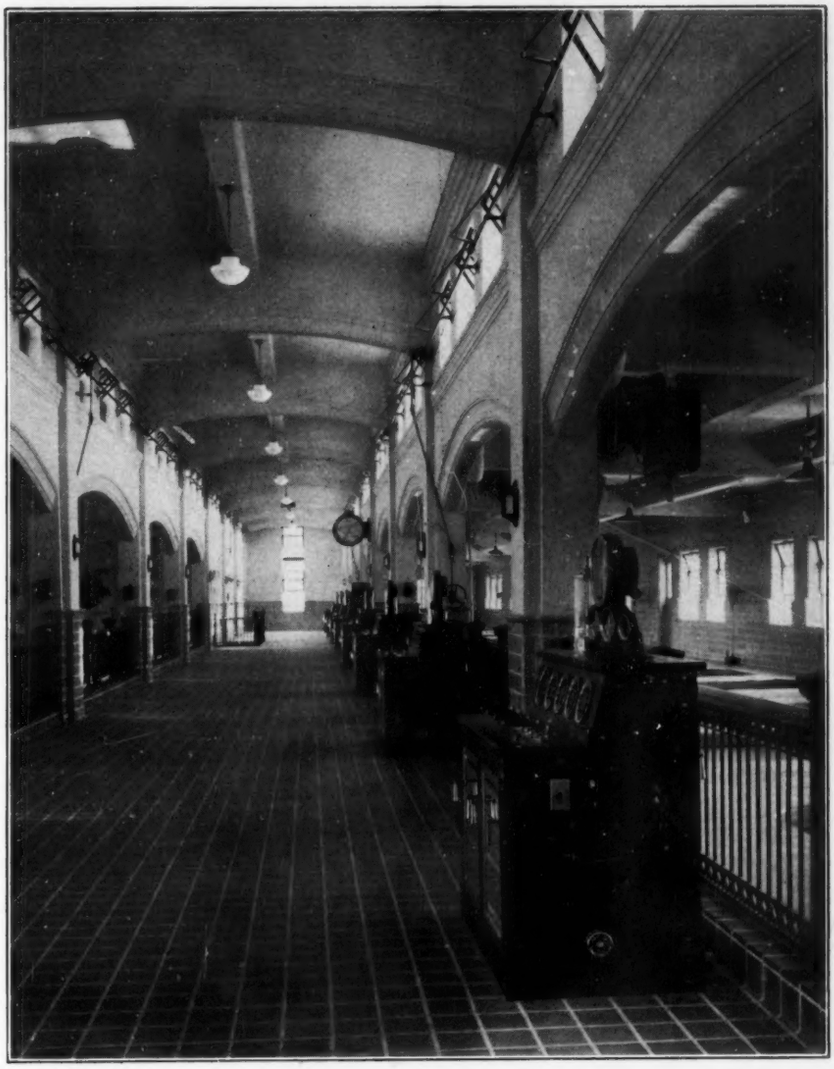


THE WORLD'S LARGEST SUPER AND DECHLORINATING PLANT
Located at Toronto's New Victoria Park Filter Plant, which will be inspected by members of A.W.W.A. on a planned tour during the Annual Convention, June 22-26, in Toronto.

commission as a war time economy. Other parts of the project, however, have been functioning for a long time past. The interior decoration of all buildings and the architectural features of the entire structure justify it being described as amongst the most modern and beautiful plants in America.

Rapid construction progress was reported on the 100 m.g.d. plant of the Metropolitan Water District of Southern California. This plant will embrace every phase of filtration, softening and taste prevention, including flocculators, clarifiers, lime-zeolite softening, lime reclamation, rapid sand filtration, recarbonation, and the use of activated carbon.

The new purification plant of Raleigh, N. C., having a capacity of 8 m.g.d. and named after Ernest Bain, associated with the water supply of that city for the past 43 years, was also placed in commission. There are eight standard filters equipped with Wheeler filter bottoms, flash air mixing, mechanical vertical paddle type mixers and Dorr flocculators. Each filter is equipped with a Simplex sand expansion gauge for washing control. Five sampling devices are piped directly to the laboratory, so that the varying degrees of purification effected during treatment can be rapidly evaluated. An attractive elevated tank of colonial design, having a capacity of 750,000 gallons, is included. The plant was constructed at a cost of $689,000, exactly $11,000 under the estimated cost.



OPERATING FLOOR OF THE NEW PLANT OF RALEIGH, N. C.
(Said to be the South's Finest)

At Lansing, Mich., the filtration and softening plant was placed in commission in December, 1939. Amongst the newer features at this plant are air conditioning, so that the inside temperature of 70° F. can be maintained and prevent condensation on walls and ceilings during the humid months. Heating elements and fans are used in the chemical room to circulate warm air against walls and surface of equipment. Air pressure controls are used in lieu of electric or hydraulic means. Provision is made to reclaim wash water. An elaborate series of sampling devices deliver to a single sampling table, which permits testing at 19 different points in the plant at one station. The testing, without windows, is lighted with fluorescent lights only to enable uniform results being obtained with colorometric indicators.

Based upon a model experimental plant, the new water filtration and softening plant at St. Paul, Minn., was completed during the year. The plant has a capacity of 75 m.g.d. and cost $687,000.

Practical completion of the new Bethlehem, Pa., water supply from the mountains 25 miles from the city, replacing the existing well and Lehigh River supply, is reported. The project cost $3,900,000. Treatment of the very soft water with lime will be necessary to correct its corrosive properties, the total hardness being only 7.9 p.p.m. The annual saving on existing filtration and purification plant maintenance will be $55,000.

Modernization of the Owensboro, Ky., water softening plant built in 1911 is well under way at a cost of $600,000. The plant when complete will include aeration, softening, recarbonation, filtration, and post-carbonation. The effluent will be chlorinated and provision is made for the use of hexametaphosphates to preclude encrustation of mains, services, and consumers' plumbing.

Considerable progress was made on the filtration plant at Chicago, designed for a peak capacity of 450 m.g.d. When completed, the new project will cost $20,000,000. It is of interest to recall the fact that Chicago established an all-time pumpage peak of just under 1,400,000,000 for the 24-hr. period ending July 24th. The maximum demand during the day was at the rate of 1,660 m.g.d.

Work is proceeding on the large $3,000,000 project to supply Harrisburg, Pa., with water from Clarks Creek, 20 miles from the city, to replace the present supply from the Susequehanna River. The scheme includes a 100-ft. high dam, storing 7 billion gallons of water, and piping by gravity through a 42-inch conduit to the existing reservoirs. No filtration will be necessary. Approval of plans to issue $18,000,000 of bonds for rehabilitating the city's waterworks at Philadelphia was announced. The plans include reconstruction

SEEMINGLY AMERICA'S MOST UNIQUE SOFTENING PLANT AND WATER TOWER

(The New City Hall of Lake, Wisc. Serves as water tower with a tank at the top. In the basement is the Zeolite softening plant and pumping station.)

of the rapid sand filters and changes in the chemical treatment of the water. Rapid progress is being made on the new Toledo supply estimated to cost $9,000,000. When completed the Maumee River supply will be abandoned and water from Lake Erie will be available. At Ashland, Ky., construction of a 20,000,000 gallon raw water reservoir was completed at a cost of $257,000. The function of the reservoir is to take care of unusual variations in the quality of the Ohio River, thus reducing treatment costs. It will also furnish adequate reserve in emergency conditions. A plant was also erected and placed in commission at Rome Ga.

At Stamford, Conn., a modern welded steel tank was completed having a capacity of 1,000,000 gallons and was a striking example of the attention being given to architectural beauty. Another tank of similar capacity and of very attractive appearance was placed in commission at Tucson, Ariz.

James E. Kerslake, Supt. of Filtration at Milwaukee, gave a frank discussion of troubles experienced during the first four months that the Milwaukee plant was operating, and outlined the steps which were necessary to be taken to overcome the temporary troubles. Too often there is a tendency to try and cover up early operating problems which, in general, may be due to equipment standing idle for considerable periods of time before being placed in operation. Release of such information by the Milwaukee authorities could be well duplicated by others in like circumstances and would not only demonstrate weaknesses but enable those placed in charge of new plants to anticipate similar trouble and be prepared to meet them.

According to L. P. Wood, New York, drought conditions have further emphasized the need of the new delaware water supply for New York City. He stated that water used in 1940 would exceed the safe yield from existing sources by 40 per cent. To date, $170,000,000 in contracts have been awarded in connection with this project.

Reservoir Silting and Correctives

At Wilmington, Del., Carl B. Brown of the Reservoir Division, U. S. Soil Conservation Service, based on nation-wide surveys and studies, stated that one-fifth of the U. S. water supply reservoirs will be useless in 50 years if eroded soil continues flowing into them, and 25 per cent might be filled to the point of uselessnes in 50 to 100 years. It is predicted that only 54 per cent will last for more than a century. Three practical methods for silt control were outlined as follows: (1) adequate consideration of the silting factors in the original location and design of the dam; (2) a plan of bottom flow release of freshet waters, designed to vent the largest possible amount of silt *before* it has a chance to deposit and compact; (3) watershed protection through co-operation with land owners to control soil erosion, or outright purchase of eroding areas for reforestration, terracing slope planting, etc.

Purification Progress

The trend toward the gravimetric type of chemical feeders is pronounced, although some volumetric machines of large capacity were installed during the year. With the increasing use of a greater variety of chemicals in water purification, including hexametaphosphate as the most recent, equipment is being continuously improved. The Omega proportioning pump is one of the latest pieces of equipment to be offered for this purpose. It is standard rubber lined, has a heavy duty plunger pump and can be used for applying copper sulfate, alum, hypochlorite, aqua ammonia, ferric chloride, caustic soda and "Calgon," the last being hexamataphosphate's trade name. This feeder is similar to others being used for the same purpose.

The use of various methods for accelerating coagulation and flocculation through mechanical agitation is extending rapidly and but few modern plants are now built without some such system. The evolution of the many systems used to procure and maintain a satisfactory floc formation is a most interesting history and is a striking testimony to the work of the research chemist and the ingenuity of the designing engineer. With new developments year after year, it is apparent that we have not yet reached the final stage in plant design or equipment. It seems probable that future work will center around some improvement in the Dorr

flocculator type of equipment. Improvements in the Jeffrey "Floctrol" were developed during the year. The principle of recirculating softening precipitate or coagulation floc has almost invariably been found to be beneficial and productive of economy, and Oklahoma City uniquely returns softening sludge mixed with the newly slaked lime to excellent effect.

From time to time several observers have reported upon the effect of temperature upon floc formation and its behaviour. Speaking in London before the British Institute of Civil Engineers, David Brownlee outlined extensive researches that were carried out in Alexandria, Egypt, in connection with designing circular clarifiers. A difference in temperature of only 0.2° C. was found to alter the separating efficiency of ordinary settling tanks because of vertical currents which impeded the settling of the precipitates. As a result of this observation it was shown that by correct design of baffles and cross sectional area of inlets and outlets, the whole mass of the water could be caused to flow uniformly with elimination of vertical and other eddies and irrespective of atmospheric changes. The outcome of these studies was the design of rectangular clarifier tanks involving three inlet baffles, each with submerged orifices, combined with inlet and outlet of correct size and shape to give uniform flow. Other plants of similar design are now being erected in India.

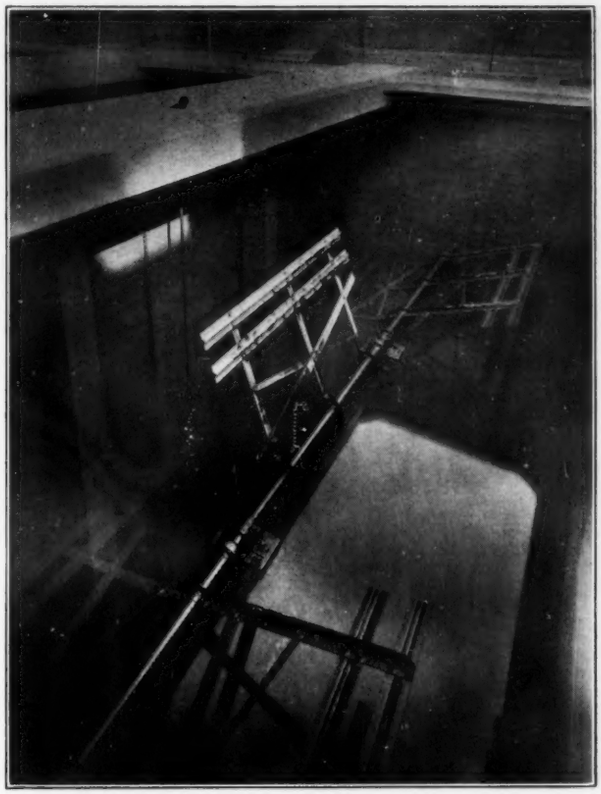
Split Coagulation

What is termed fractionated coagulation was described by Trelles, Bengoles and Poccard. This method of treatment was used on the River Plata water in the Argentine. It consists of adding the total dose of coagulant in two fractions, leaving a time interval between doses and employing either aluminum salts alone or using them for the first fraction and iron salts for the second. The authors conclude that 8 per cent alum can be saved by efficient diffusion of coagulant and 16.7 per cent by fractional coagulation, while the latter resulted in better quality of settled water along with a saving of coagulant. [This development cannot be considered new, for it has much earlier been done by Hedgepeth and others in America.]

At Reading, Pa., W. Stockbine described the combination use of excess chlorine in the raw water and sulphate of iron (copperas) to destroy taste, and at the same time produce superior and less expensive coagulation. The copperas, being ferrous sulphate, successfully served as the dechlorinating agent, producing in effect "chlorinated-copperas," $FeSO_4$:Cl. Later ammonia was added just ahead of the copperas to form chloramine and thus bind up some of the excess chlorine for sustained disinfection through the basins to the filters. With a similar scheme at Wheeling, W. Va., A. R. Todd reports effective taste control. There ferrous sulphate is present in the raw water and heavy pre-chlorination is practical.

In line with present practice of maintaining plant cleanliness and making equipment more convenient for filter plant operators to use, a new dust remover and filter manufactured by the Omega Co. made its appearance during the year. This can be attached to a standard dry feeder or in larger sizes can be installed as a separate unit and piped to several feeders.

Dustless "black-alum," still comparatively new, has proved its value and doubtless will be utilized to a greater extent when its advantages are better known. This material is filter alum, which contains activated carbon. The use of chlorinated bleaching clay has been shown to be a cheap product for assisting in floc formation, notably in waters which precipitate slowly, or in



THE POPULARITY OF MECHANICAL FLOCCULATION UNITS CONTINUES

(This one is in the new Raleigh, N. C., plant.)

supplies which normally require comparatively large doses of coagulant for effective flocculation. At Sussex (New Brunswick) "black alum," used jointly with lime, proved superior to ordinary filter alum and also eliminated taste.

A symposium on lime published by the American Society of Testing Materials contained a mass of useful information which included: (1) factors affecting milk of lime employed in industry; (2) quality of lime desired for water treatment; (3) prevention of after precipitation in lime-treated industrial and municipal waters by "Threshold" treatment; (4) soil acidity and liming, and some factors that should determine the standards for lime for the soil; (5) preliminary investigation of the determination of fluorine in lime; (6) fundamental mechanics of calcination and hydration of lime and methods of control.

Filter Beds and Bottoms

With the expiration of the patent controlling Wheeler Filter Bottoms, several installations have been made during the year, including Raleigh, Akron, Toledo and Sandusky. The use of concrete duplex under-drain system enabled the reduction in the depth of gravel at the plant at Leavenworth, Kan., and the use of a backwash rate of 36-inch vertical rise. The cost of the underdrain system is said to have been practically the same as would have been involved in standard practice. At Washington, D. C., the slat-type filter bottoms are being replaced by a grid-type system using perforated "Transite" pipes. The use of porous filter plates (fused alumina plates) at Flat Rock, Mich., and elsewhere has made it possible to eliminate the gravel layers, increase the freeboard, employ higher wash rates and generally improve the backwashing system.

Regardless of the fact that some plants have put in sand having an effective size ranging between 0.35 and

0.45 mm. in new filters during the year, the general tendency is to use sand considerably larger. At Newport News, Va., Dugger recently demonstrated that a filter medium consisting of one-third coarse anthrafilt (0.72 mm.) as the upper bed and two-thirds sand below it, effectively extended filter runs of 12 hours to between 70 and 90 hours. The shortened filter runs were due to excessive growths of algae. It was, however, pointed out by F. E. Stuart (Baltimore) that with the anthrafilt-sand combination, filter bed agitation in washing appeared to be an essential factor in the successful use of this combination of filter media. Experimental work carried out in Toronto some years ago, with anthrafilt and sand, confirm Dugger's experiences. Some trouble was, however, experienced at Toronto in washing, which, as Stuart has pointed out, may be overcome by some form of mechanical agitation in conjunction with the water wash.

ELEVATED AND GROUND TANKS ARE DESIGNED MORE ATTRACTIVELY THAN EVER BEFORE
(This one was fabricated for the Stamford (Conn.) Water Company.)

Filter Washing

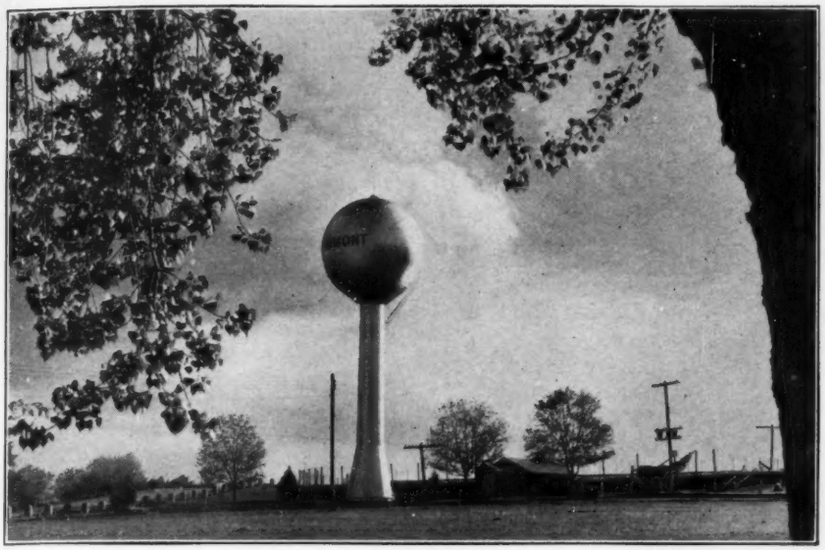
While the advocates of high velocity wash still maintain that this system will effectively keep filter beds clean, it has not been generally adopted, partly because it has not completely sold itself. Mudball formation has been reported using the high velocity wash system. Fundamentally it seems to be sound, and it is possible that unless the filters are especially designed for this method of washing, it may not be successful. The writer still thinks that some day there will be a reincarnation of the preliminary sand scrubbing air wash, applied immediately prior to the standard wash. Meanwhile, the newer method of surface washing or "bed agitation," as it has of more recent date been termed, has come to the front. To John R. Baylis of Chicago credit must be given for having introduced this practice. Later Ira A. Jewell, who recently died in Chicago, patented a process known as the Jewell Subsurface filter washing system, and within the last few years the Palmer Filter Bed Agitator with revolving jets was developed by Palmer at Erie, Pa. The latter system is installed or being installed in 60 plants in America, one of the largest and most recent cities to adopt it being Buffalo, N. Y. Judging from the favorable reports coming from those using the surface wash or bed agitation schemes, the future of this method would seem to be assured, providing it is not exploited. Amongst the recent claims made for surface washing are elimination of mud balls, longer filter runs, elimination of odor and taste troubles, due to decomposing organic matter in dirty sand, and a reduction of 25 to 35 per cent in amount of wash water.

Algae Control Developments

In the control of algal growths, some interesting developments were reported during the year. In earlier years we heard of the use of clay at Louisville, Ky., and elsewhere to cut off light and check algal growths. The use of activated carbon for the same purpose is new. Carbon applied in doses as low as 6 pounds per million gallons was reported at Council Bluffs, Iowa, by W. T. Bailey, for successfully inhibiting algal growths in sedimentation and coagulation basins over 200 feet long and 20 feet deep. The term "Blacking Out Algae" was adopted by Bailey as an expressive one in describing this form of treatment.

In controlling plankton growths in the large settling basins at Indianapolis, C. K. Calvert found that cuprichloramine (consisting of copper sulfate, chlorine and ammonia) was useful in plankton control, but that copper sulfate and chlorine applied in correct dosage was more generally effective. No particular virtue was found in the combination of the three chemicals. Calvert, in fact, reported that the cupro-chlorine treatment was more helpful than when ammonia was used jointly with these two reagents. Some years ago the late Dr. Harold told the writer that the effectiveness of chloramine could only be maintained in bright sunlight by greatly increasing the ratio of ammonia to chlorine, but as Calvert points out, an excess of ammonia tends to furnish food for certain types of algae. Calvert's findings on the action of sunlight to chloramines suggests a large excess of chlorine is necessary if aftergrowths are to be controlled in water exposed to sunlight.

Carl J. Lauter, Washington, D. C., showed that considerable economies could be effected by using aqua ammonia for chloramination instead of anhydrous am-



THE NEWEST THING IN WATER TANKS—"THE WATER SPHERE"
(This, one of the first installations, is at Longmont, Colo.)

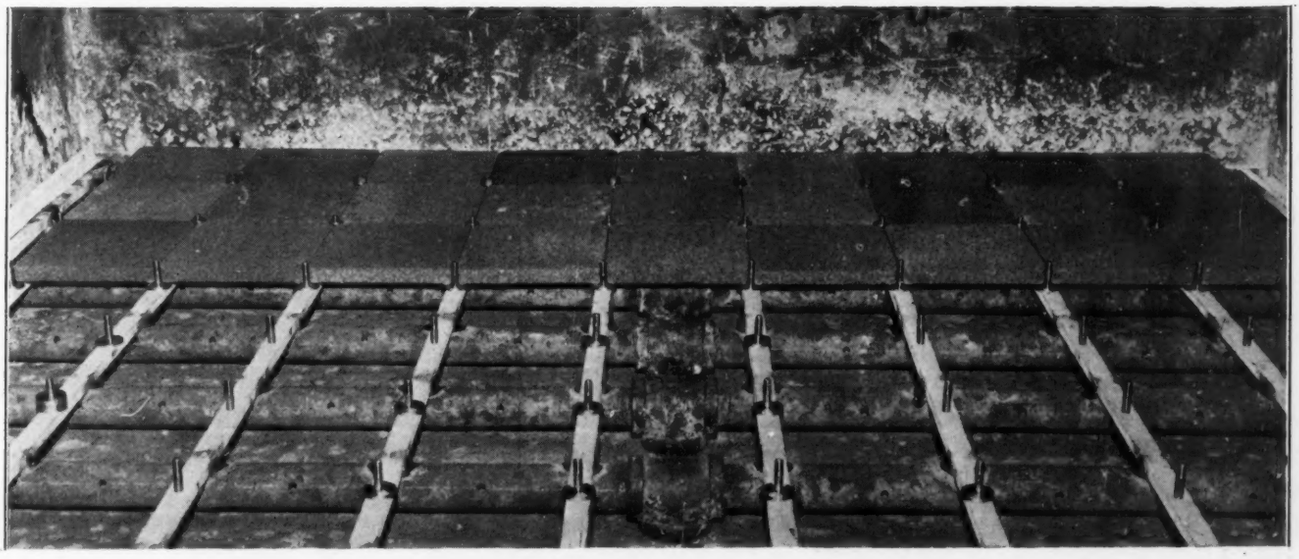
Horace A. Brown

The "Super-Collosal" Chlorinator Who Made Water Treatment History in 1940 at Ottumwa, Iowa. (The story is in WATER WORKS & SEWERAGE *for April, 1940.)*

monia. He pointed out that modern feeders are especially suitable for solutions of this character and that operating costs for ammonia could be approximately cut in half.

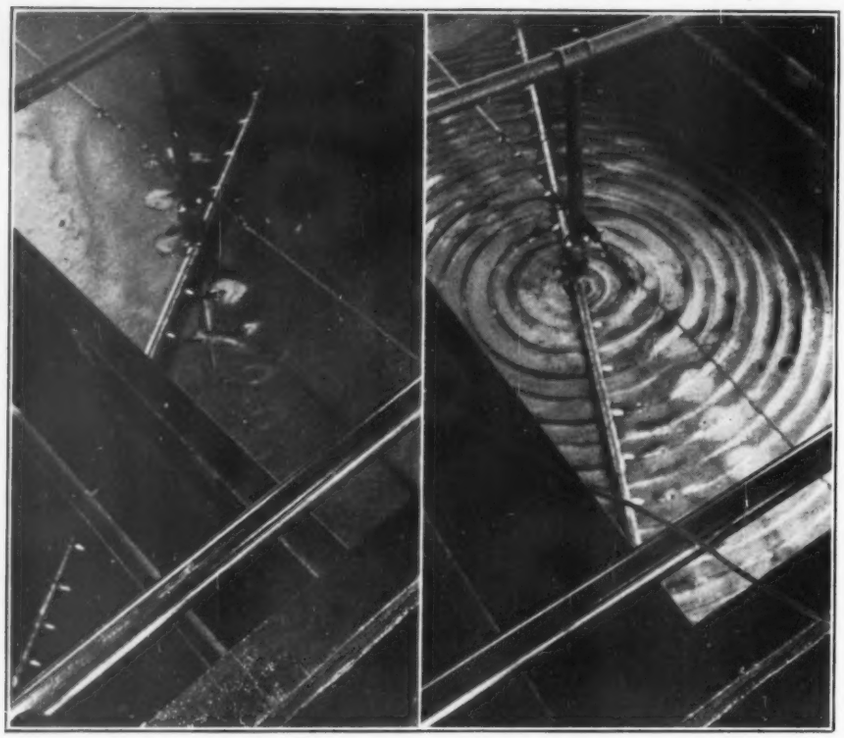
Super-Chlorination Comes Intq Its Own

Rapid expansion of super-chlorination was one of the features of the year. This was doubtless due to publicity following the description of "break-point" chlorination by W. J. Orchard, Newark, N. J., together with the fact that the effectiveness of the method has been successfully demonstrated in some cases in rather an inspiring manner. It is strange that it has taken some fourteen years to sell super-chlorination treatment, which was inaugurated in Toronto on a large scale some twelve years ago and has been continuous since. During the past few years the writer has frequently stated that if super-chlorination was unsuccessful in preventing taste, in a large majority of cases it was due to the disinclination to add sufficient chlorine or the inability to do so. It is admitted that there are some waters so heavily polluted with organic matter and trade waste that this form of treatment will not always be effective, but if it is used in combination with some other reagent its success can be assured. What is chiefly referred to here is after-tastes and odors, which invariably can be removed by activated carbon. Experiences during the year have shown that in certain cases nothing short of what has been termed "super-super" chlorination, in really courageous doses, were successful in treating a seemingly untreatable water. What may possibly go down in history as the outstanding achievement of a decade in water purification was that described by H. A. Brown in treating the Des Moines River water at Ottumwa, where the largest recorded dose of chlorine ever applied to a city's water was employed for taste correction. The local press described the treatment as "Super-Collosal-Chlorination"—and so it was. Brown has reported that it was necessary to raise the application of chlorine from 2 to 112 parts per million to establish the so-called "break-point" and produce the results sought. Moderate super-chlorination had failed. The severity of taste and odor conditions can best be gauged when it is pointed out that 400 pounds per million gallons of activated carbon failed to correct the taste in the water. Super-chlorination proved successful not only in reducing the threshold odor to less than 2, but gave the additional protection necessary to safeguard the final quality of the city supply. During the heavy pollution period, when the river was frozen over,



POROUS PLATE FILTER BOTTOMS ARE COMING INTO THEIR OWN
Their many features of interest have only awaited proof that cloggage is not of serious consequence.

WATER WORKS & SEWERAGE, January, 1941



THE PALMER "FILTER SWEEP" HAS ENJOYED RAPID ACCEPTANCE AS A SAND SCOURING UNIT

the raw water contained no dissolved oxygen, fish died in large numbers, and the bacterial pollution was excessive.

C. K. Calvert has thrown a deal of light on problems associated with the rather obscure chemical reactions which may be involved in certain types of water when excess chlorine treatment is used. He stated, "A full understanding of causes and effects will clarify the present confusing situation." The action of chlorine on ammonia was carefully studied by both Calvert and A. E. Griffin, Newark, N. J. Calvert found little difficulty in destroying chlorophenol taste and odor by super-chlorination in the presence of moderate amounts of nitrogen as ammonia. With higher nitrogen content the ratio of chlorine to ammonia for oxidation was found to range between 7.5 and 20 chlorine to 1 ammonia. The chart prepared by Griffin (see cut) clearly shows the effect of chlorine on ammonia, the ratio being approximately 10:1. After the break-point has been reached, the ammonia-nitrogen curve starts rising and finally straightens out. It is not yet known just what this reaction involves. Griffin's paper entitled "Recent Advances in the Chlorination of Water," presented at the Maryland Delaware Water and Sewage Association, included considerable new material.

L. J. Alexander (Los Angeles) reported that super-chlorination followed by dechlorination had been successful in controlling taste and odor caused by iron and sulphur groups of bacteria in Southern California. Both sulphur dioxide and granular activated carbon were used for dechlorination. Alexander found that the carbon bed required involved 1.5-2.0 cu. ft. of carbon for each gallon per minute flow of water being dechlorinated.

In the past, and to a lesser degree now, the chief problem in super-chlorination has been to devise some simple method of control. In rapidly fluctuating waters this is very difficult, because both the time contact and the correct dosage are the two controlling factors. Recently P. C. Laux (Anderson, Ind.) stated that break-point doses can be controlled by observing the speed with which ortho-tolidin color develops in the excess chlorine test. After the break-point is reached, the full color develops almost spontaneously and certainly within the first minute of contact.

Activated Carbon

The use of activated carbon continues to expand on its merits. During the year nothing new of any magnitude regarding carbon use was reported. A possible trend was noted at some of the smaller plants, where it has become routine practice to continuously apply small doses of carbon for its insurance value, against taste and odor, so as not to be caught with a over-night development of taste. In this regard, Milledgeville, Ga., and Wilson, N. C., can be mentioned, not forgetting several others. While no considerable tonnage or carbon is involved, the development is definitely significant as an indication of the changing attitude regarding expense vs. water quality amongst operators of plants producing one million gallons a day or less. Improved storage facilities and equipment are being employed for handling carbon. Modern equipment provides for prevention of excessive dusting when the carbon is being loaded or fed. Earlier in this article reference was made to dust control equipment used for this purpose. A particularly complete installation was recently installed at Royersford, Pa., where the chemical storage and feed room are serviced by a complete dust-collecting system.

In the plant of the Metropolitan Water District of Southern California carbon is to be stored and fed as a slurry. The same system is to be employed in the Milwaukee plant, where some trouble has been experienced with the dry powder.

During the year a small ozone plant was put in commission at Denver, Pa. An interesting feature of this plant is that the contact (solution) column normally used for mixing the ozone with water was eliminated and the ozone was mixed in the clear well water by means of Aloxite diffusers and a power-driven absorption wheel of special design.

In the Journal of the American Water Works Association, L. S. Renzoni, Port Colborne, Ont., described a new method for estimating small amounts of phenol in water containing sodium sulfide. A pheno concentration of one part per billion can be accurately estimated, he claimed.

Corrosion Control

A great deal of work on causes of corrosion and methods of correction was carried out in 1940. According to Lee (San Francisco), cathodic protection on domestic distribution systems consists of rendering all portions of the pipe negative to the soil and changing anodic areas to cathodic areas.

Up to the fall of 1940, over 600 water tanks had been equipped for cathodic corrosion control. The opinion has gained ground that with cathodic protection,

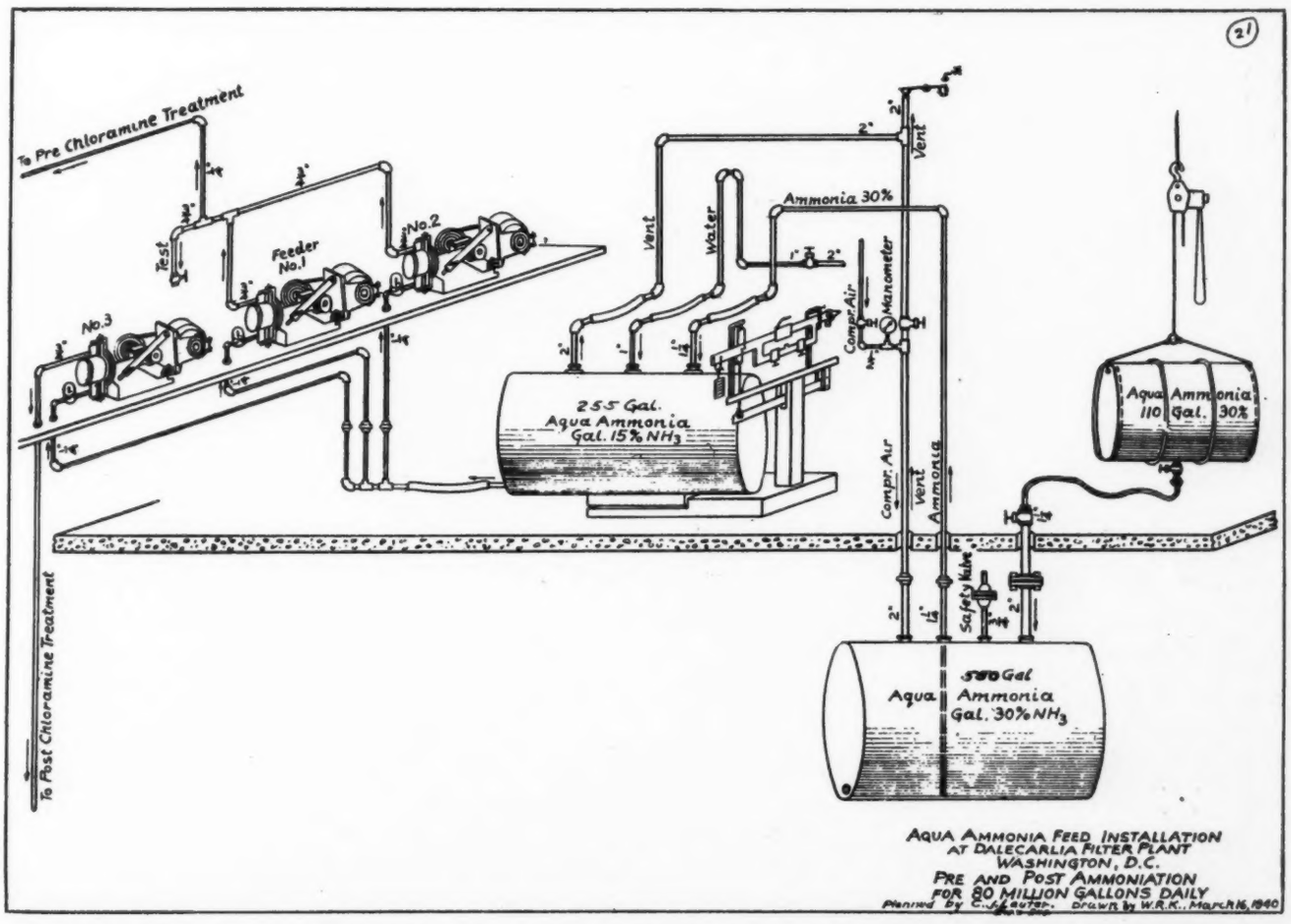
internal painting of steel tanks below water level may not be necessary.

According to H. G. Taylor, the fear of corrosion of buried copper gas and water pipes is unjustified. He claimed hydrogen-ion content, amount of moisture, total acidity or alkalinity, nature and concentration of salts present, grain size, aeration of soil and electrical resistivity were the controlling factors. Where corrosion does occur it is largely due to galvanic action caused by connection directly with cast iron or steel pipe. Under such conditions copper tubing should not be protected by insulating wrapping unless completeness and permanency of wrapping can be assured. Out of 5.5 million copper services installed in Sydney, Australia, only 9 feet had become defective up to last year. Tronstad and Vierno stated that the decisive factor of corrosion of copper pipes (by water) are oxygen and aggressive carbon dioxide. All other constituents play a minor role. Correction of pH to 8.5, preferably with lime or limestone or combination of both, is considered the best method of control.

What can be said to represent the official viewpoint of the American Water Works Association on protective grounding of electric installations was ably outlined by H. E. Jordan, New York. He said, "The water supply industry does not accept responsibility for providing the means of disposal of stray or waste electric current, nor does it recognize any legal right of other utilities or services to impose upon its property and services the function of disposing of stray or waste electric current."

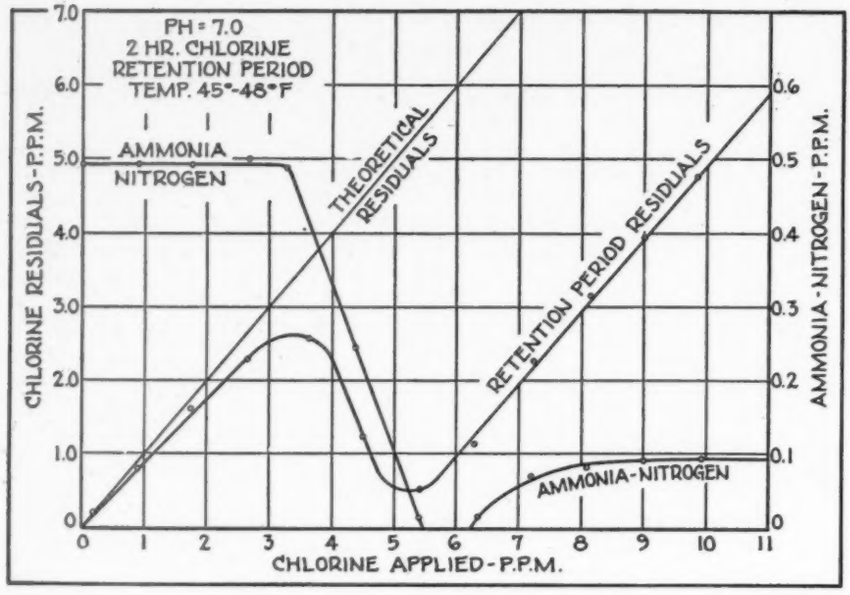
Hexametaphosphate as Corrosion Corrective

The use of sodium metaphosphate for corrosion control made great headway during the year. Dr. K. K. Jones, Chicago, Ill., after an elaborate physiological investigation concluded that hexametaphosphate is no more toxic to the human system than any physiologically active salt. According to Owen Rice, the hexametaphosphate "Calgon" inhibits corrosion as a result of adsorption of a thin film of this substance upon the surface of the metal. In a few cases it was shown that "Calgon" loosened old deposits of manganese and iron within the distribution system and caused considerable trouble, also the bacterial count was found to increase in certain supplies. Rice stated that out of 150 municipal water supplies using "Calgon," such troubles had been reported in only four cases. These were due to "loosely adherent deposits of iron oxide and manganese" becoming detached from the inside of the pipes. In three cases the trouble disappeared following adequate flushing. Increase of the bacterial count is disturbing, but unless proved otherwise should not be regarded as of sanitary significance. If, however, certain potentially dangerous types of bacteria were rejuvenated or stimulated by the use of phosphate, the situation might be different. There is, however, no record or immediate indication of such a condition. One property of "Calgon" mentioned by C. P. Hoover, Columbus, is that when applied to softened water prior to filtration it will prevent the deposition of calcium carbonate on filter sand. In industry "Calgon" has been employed with con-



WASHINGTON'S INSTALLATION FOR AQUA-AMMONIATION RESULTED IN MARKED ECONOMY IN CHLORAMINATION

WATER WORKS & SEWERAGE, January, 1941



GRAPH REVEALING THE RELATIONSHIPS BETWEEN AMMONIA CONTENT AND EXCESS CHLORINE WHEN SUPERCHLORINATING TO THE "BREAK-POINT" AND BEYOND.—BY A. E. GRIFFIN

siderable success as a preventative in scale depositions at vulnerable points in hot water systems.

According to Federal Security Administrator Paul V. McNutt, the current Treasury Standards for Drinking Water (those set up in 1925) will give way within the next two years to new regulations which will also embody a code of water works practice. The possibility of more severe standards for drinking water is now a real issue. One of the problems at present encountered in many cities during the summer months is that of water quality depreciation in distribution systems, including bacterial aftergrowth. While it is generally recognized that these conditions may be of little sanitary significance, the fact remains that more severe standards will add to existing operating problems and purification expense.

During the year Harry A. Faber, of the Chlorine Institute (New York), drew attention to the effect of temperature upon water depreciation in the distribution system. He pointed out that a temperature induced bacterial activity resulting in decomposition of organic matter, the dissipation of oxygen, the evolution of carbonic acid and organic acids which tended to lower the oxidation potential and the pH value of the water, especially at the point of contact between the slime coating and the pipe wall. The net result was the solution of iron and production of red water or black sulphide water. In the latter circumstance, as the reaction proceeds oxygen may be depleted locally to a point where actual septic fermentation is produced and sulphates are reduced to sulphides which produce black water rather than red water. Chloramine treatment was suggested as one means of preventing after growths in the distribution system and of simulating conditions imposed by low temperatures.

Main Lining in Place

Increased interest appears to have been given to the cement lining of both large and small diameter pipes, following the lead given by James Gibson in 1939, when 2½ miles of 4, 6, and 8-inch mains were cleaned and relined in place in Charleston, S. C. Paul Weir, Atlanta, drew attention to the value of low soluble cement as a protective coating for cast iron and steel pipe. At Akron, W. R. LaDue described the successful completion of cleaning and cement lining 20,000 feet of 36-inch and 14,000 feet of 48-inch mains. The mortar lining consisted of 1:1 mixture of Portland cement and dry screened sand passing a No. 16 screen. Thickness of the lining was from ¼ to ½ inch. The cost to the city was less than $2.50 per foot of main lined. The first use of 48-inch centrifugally made cast iron pipe cement lined was reported at Wichita, Kansas, to be used in connection with the new water supply system being constructed at a cost of $2,425,000.

[At West Palm Beach, Fla., a large project of cement lining of distribution and trunk mains has been recently completed under the direction of Malcolm Pirnie as Consulting Engineer.—Ed.]

A new jointing material appeared in England for caulking and packing all kinds of water mains. It is known as "Philplug" jointing material, is in powder form and is made usable by mixing with water. It has been rigidly tested and has the approval of the British War Office and of the Ministry of Air. In America, R. H. Hyde (California) developed an improved joint packing ring of rubber for poured joints.

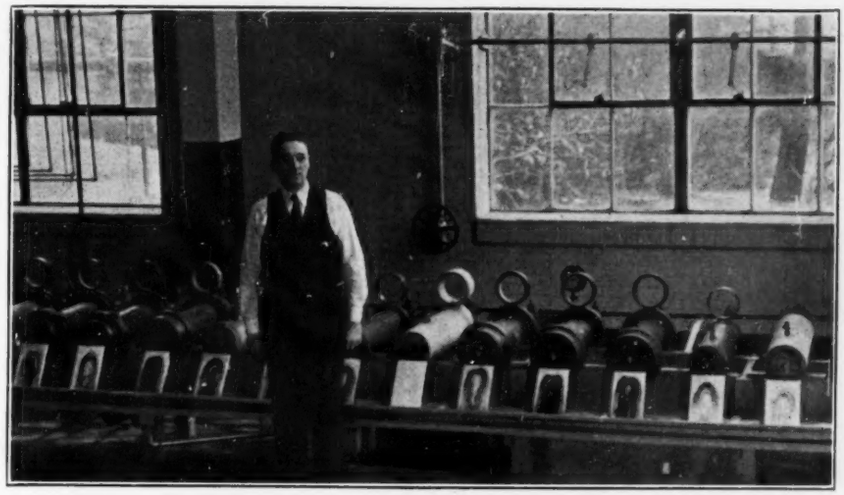
Water Works Protection a Live Topic

For the first time in a decade the American continent has suddenly become conscious of the danger of sabotage to public utilities. In Canada, protective measures have been in effect since the outbreak of the war. In the United States many publicly spirited municipal bodies have established local organizations covering every phase of emergency. Oklahoma City was one of the first to set the lead. Elaborate steps taken in England to protect the London water supply against air raids have only recently been completed at a cost of $2,000,000. H. E. Jordan, New York, has just completed a comprehensive treatise entitled, "Preparing Water Supplies to Meet Emergencies." This will shortly be available through the mediumship of the Journal of the A. W. W. A.

It is of interest to record very briefly just what protection has been given to waterworks properties in Great Britain. Buildings have been protected with sand bags and timber reinforcements. Windows have been boarded up or treated with anti-percussion preparations, and air raid shelters provided for the staff. New equipment other than repair sleeves have been developed for rapidly repairing fractures in the distribution system. [Some of the methods and equipment are described by Trevor in the June, 1940, issue of this magazine.] Emergency underground supplies have been provided while all available sources of unfiltered water have been charted and mobile fire-fighting units provided. The location of these has been recorded in different areas. Many of the large plants have been camouflaged in a most ingenious manner. The person-

nel of the staff have been carefully scrutinized and admission only by pass is the order of the day.

In Britain and America new portable emergency water purification units were developed during the year by Glenfield and Kennedy in England, and in America by Wallace and Tiernan, Proportioneers, Inc., and U. S. Army Engineers. Generally speaking, they consist of gasoline or oil driven pumps, filters and chlorinator units mounted on skids or a truck or trailer. Most of the units have a capacity of from 250,000 to 1,000,000 gallons in 24 hours. A new mobile pumping unit was also announced having an armored suction and delivery hose of 8-inch diameter and capable of pumping over 1,000,000 gallons a day against about 350 foot.



CORROSION STUDIES AT ATLANTA, GA.

Superintendent of Filtration Paul Weir (Chairman of the Water Purification Div. of A.W.W.A.), with his battery of 30 specimens of pipes of various materials and protective linings.

During the year a "Manual of Water Quality and Treatment," published by the American Water Works Association, made its appearance. In condensed form the twelve chapters cover every phase of water purification. Already the demand has practically exhausted the first printing of 1,000 copies, an unfailing index of the need for such a reference work and guide.

A Lesson Learned in 1940

Possibly the greatest practical demonstration in recent years of the danger of hidden cross connections was that at Rochester, N. Y., near the close of 1940, when a workman inadvertently opened a connection between the Genesee River fire supply system and the city water supply system, permitting more than 6,000,000 gallons of heavily polluted water to enter the distribution system. According to Harold W. Leahy, City Chemist, more than one-third of the first batch of samples examined showed gross bacterial pollution. At this writing it is still too early to know what the ultimate effect on public health is to be. Within 48 hours of the accidental pollution, 100 cases of dysentery had been reported in 5 local hospitals. As soon as the gravity of the situation had been realized citizens were warned by radio broadcast, and through the press, to boil all drinking water, and emergency main-chlorination was instituted. Typhoid fever immunization by the use of vaccine was utilized on a large scale throughout the city.

MACHINE AND EQUIPMENT USED IN LININ G MAINS WITH CEMENT MORTAR BY THE "CENTRILINE" METHOD

(This picture was taken on the Akron, Ohio, job.)

SEWERAGE FOR STUDENTS AND ENGINEERS

SEWERAGE AND SEWAGE TREATMENT—By Harold E. Babbitt, M.S., Professor of Sanitary Engineering, University of Illinois. Fifth Edition, New York: John Wiley & Sons, Inc.; London: Chapman & Hall, Ltd. Cloth, 6x9; pp. 648; illustrated. $5.

Reviewed by C. E. KEEFER
BUREAU OF SEWERS
BALTIMORE, MD.

A comparison of the first edition of this book with the present edition indicates the decided progress that has been made in sewerage practice in recent years. The present edition is a concise yet comprehensive treatise on all phases of sewerage practice. With only a few exceptions, mention is made of all of the more recent developments and improvements in sewage-treatment processes. With a few exceptions the author has presented the subject in a clear manner, placing emphasis on important matters and devoting little space to unimportant details.

The book falls into two parts. The first half, covering about three hundred pages, deals with the design, the construction and the maintenance of sewers, storm drains and their appurtenances, and the remainder treats of sewage disposal. Of the two sections of the book, the first half is by far the better.

His discussion of sewage quantities, the hydraulics of sewers, the design, the construction and the maintenance of sewers and the design of sewage pumping stations is well done. His chapter on the operation of sewage works is to be commended. He has rightly stressed the danger, which many engineers apparently overlook, of cross connections at sewage-treatment works and sewage pumping stations. He has also included an interesting discussion of trade wastes and their treatment. The book contains two appendixes. The first includes over one hundred problems, which will add to the value of the book for classroom purposes, and the second contains an extensive and useful bibliography.

In reviewing the book, exception may be taken to a number of statements. The following are some of these. Prof. Babbitt states that centrifugal sewage pumps in general "operate at a low speed of about 1,150 rev. per min." This speed is excessively high; speeds under 600 rev. per min. are more common and result in less wear. He also says that bronze shafts for centrifugal sewage pumps are generally used. This statement is incorrect; steel shafts with bronze sleeves at the stuffing boxes are in general use.

In his discussion of sewage treatment several of the author's statements are either obscure or incorrect. For example: The statement (page 316) that "volatile matter is usually a highly troublesome constituent of sewage requiring chemical means for its removal" is confusing. Most of the volatile matter in sewage is removed without the use of chemicals.

In the discussion of screens the following statement, which is somewhat ambiguous, is made: "Movable screens with a cage or box at the bottom are sometimes used. The box should be of solid material to prevent the forcing of screenings through it when the screen is being raised for cleaning." The statement that "burning or incineration has been found to be the most satisfactory method for the disposal of screenings" needs to be qualified.

The author makes the following assertion, which, generally speaking, is incorrect: "Experiments show that the efficiency of sedimentation tanks, expressed as the percentage removal of settleable solids from the influent, varies between 10 and 40 per cent, and rarely reaches 50 to 60 per cent." Sedimentation will ordinarily remove 80 to 95 per cent of the settleable solids from raw sewage and from 50 to 75 per cent of the total suspended solids. Hazen's diagram (Fig. 174) showing the sedimentation obtained in settling basins, is not clear, as the meaning of the symbols used is not given.

The statement that the depth of sedimentation tanks, exclusive of sludge-storage space, should not exceed 10 ft. is at variance with actual practice. At many plants tanks deeper than 10 ft. have been used satisfactorily. The author states on page 416 that the Illinois State Department of Health requires 2½ cu. yd. of sludge-digestion space per capita in Imhoff tanks; he means cubic feet. He says that the moisture of digested sludge drawn from Imhoff tanks is about 80 per cent. Moistures varying from 85 to 95 per cent are more nearly common in the United States.

The suggestion is made that the influent to trickling filters pass through a 1-in. screen. Screens with much smaller openings are generally used. At Baltimore, Md., 20-mesh monel wire screens are provided. Prof. Babbitt states that the amount of sludge to be cared for in humus tanks amounts to about 2 to 4 cu. ft. (15 to 30 gal.) per million gallons of sewage treated. This quantity is much less than that usually handled. As a rule, the amount varies from about 400 to 800 gal. per mil. gal. of sewage.

The author states that cast iron or steel is not suitable for air pipes at activated-sludge plants as rust or scale may break off and clog diffuser plates. Cast iron is used almost exclusively for this purpose, as has been the case at plants serving Columbus, Ohio; Baltimore, Md., and elsewhere.

It is stated that the preparation of sludge lagoons requires leveling the ground and laying underdrains in sand or gravel if the ground is not porous. Neither of these is an essential feature of sludge lagoons.

The statement that Conkey filters are provided with strings to remove the cake is incorrect. The FEinc filter has this feature of design, the Conkey filter has not. Prof. Babbitt maintains that elutriation removes some of the *insoluble* materials that act as inhibitors of coagulation. This opinion is at variance with the investigations of Genter (not Gentry, as given by Prof. Babbitt) and McNamee, who conclude that elutriation removes a considerable portion of the soluble ammonium bicarbonate, which inhibits coagulation. The insolubles are of little consequence.

In discusing Imhoff tanks, the author states that "no other preliminary treatment need be given the sewage than coarse screening" when Imhoff tanks are used. Where a city is served by a system of combined sewers, grit chambers are essential to pretreat the sewage before it flows to Imhoff tanks. Other preliminary treatment may also be used such as chlorination and grease removal facilities.

When considered in the light of the foregoing criticism, the book would have been materially improved if it had been painstakingly edited. However, it should serve a useful purpose as a text for students and as a reference for engineers when interpreted with care.

ILLUMINATING MILWAUKEE'S WATER PURIFICATION PLANT

By ARTHUR RYNDERS
Mechanical Engineer
CITY ENGINEER'S OFFICE
MILWAUKEE, WIS.

The quality of lighting in the Milwaukee Filter Plant struck us so forcibly that we made a special request that this article on illuminating a modern plant be prepared to follow the general description of Milwaukee's new plant by City Engineer Schwada in our April and May, 1940, issues.

We do not recall having seen a better lighted plant, nor do we recall any recent article dealing with plant illumination. Therefore, this article should prove of especial worth for its reference value. The author, who had charge of electrical design, deserves high recognition for the results attained.

Although the plant of Milwaukee is a large one, the principles followed in its illumination will apply equally to smaller plants, both water and sewage. The units tabulated can be basically the same except that there will be fewer of them required.—L. H. E.

GOOD illumination is one of the many features incorporated in the design of the Water Purification Plant. Such was accomplished by using a complement of natural and artificial illumination. This paper will describe the system of artificial illumination.

Feeder Lines and Transformers

Power for the system is obtained from the 2300 volt, 3 phase, 60 cycle bus in the pump room and is distributed over two 2300 volt, 3 phase feeders running through the plant. (See Fig. 3.) Switches are installed so that power can be taken from either or both of these feeders. Three banks of distribution transformers are fed from this feeder system. One bank is located in the substation and two are located in vaults near the center of the filter building. Each bank consists of three 25 K.V.A. single phase transformers, 2300-460

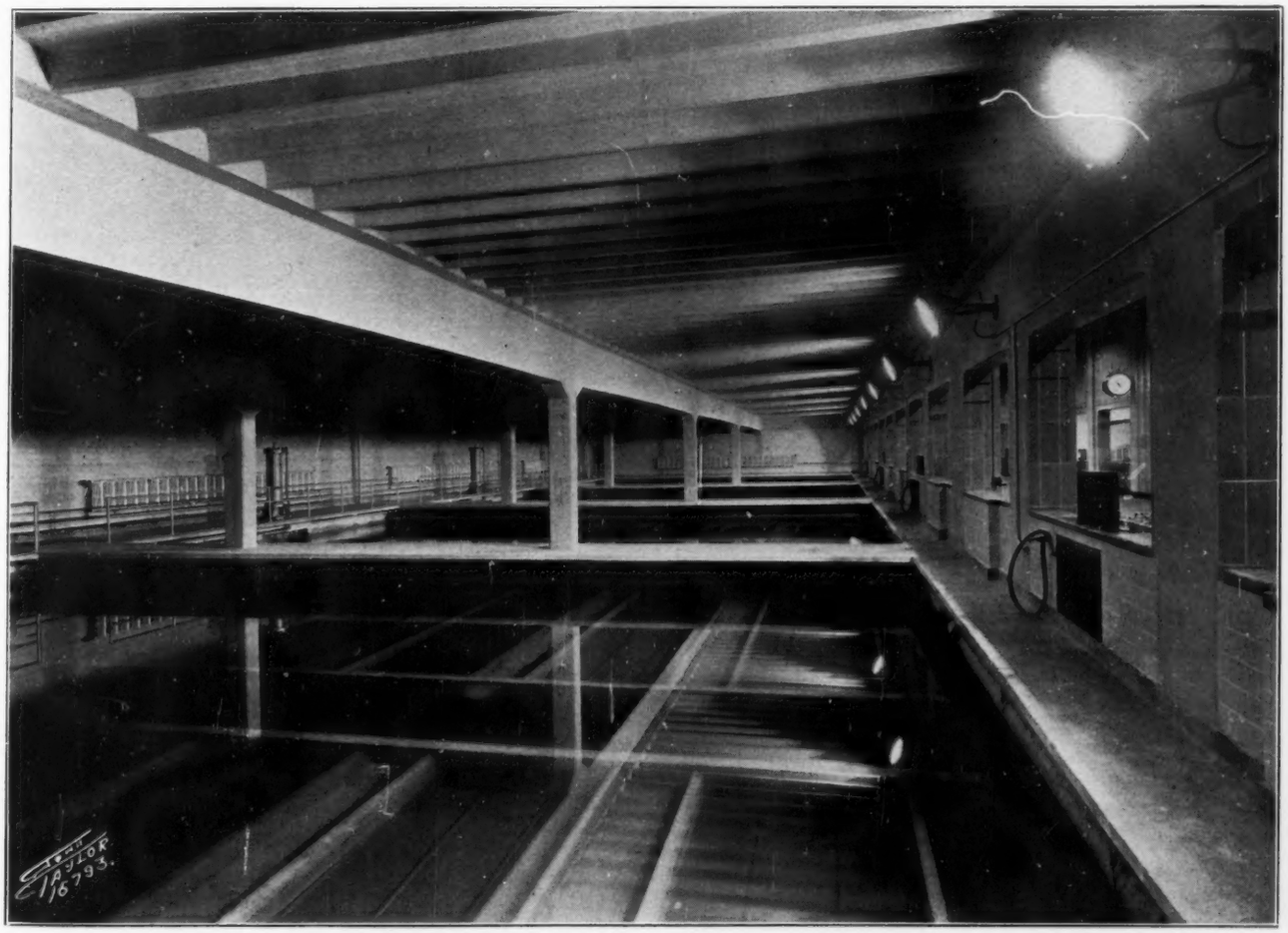


Fig. 1—Milwaukee's Filters With Flood Lights On

Note absence of glare and surface reflections. The pipes of the surface wash system are visible just above sand level.

volt, connected delta-delta for auxiliary power, and one 50 K.V.A. single phase transformer, 2300-230/115 volt, for lighting. Supplementing these, four 10 K.V.A. air-cooled insulating type 460/230-230/115 volt transformers are installed in the ends of the filter building.

Distribution Panels

Distribution panels were set up as shown, L-1, L-2, etc. (Fig. 3), indicating lighting distribution panels, and P-1, P-2, etc., indicating auxiliary power distribution panels. All distribution panels are of the nofuse type. Each lighting panel includes the breakers shown, the breakers necessary for the distribution circuits, and a few blank for possible future additions. Cabinets for the distribution panels provide wiring gutters at the top, bottom and sides, and are built dust-tight or standard, and are mounted flush or on the surface as conditions warranted. All cabinets are provided with locks keyed into the master key system of the building.

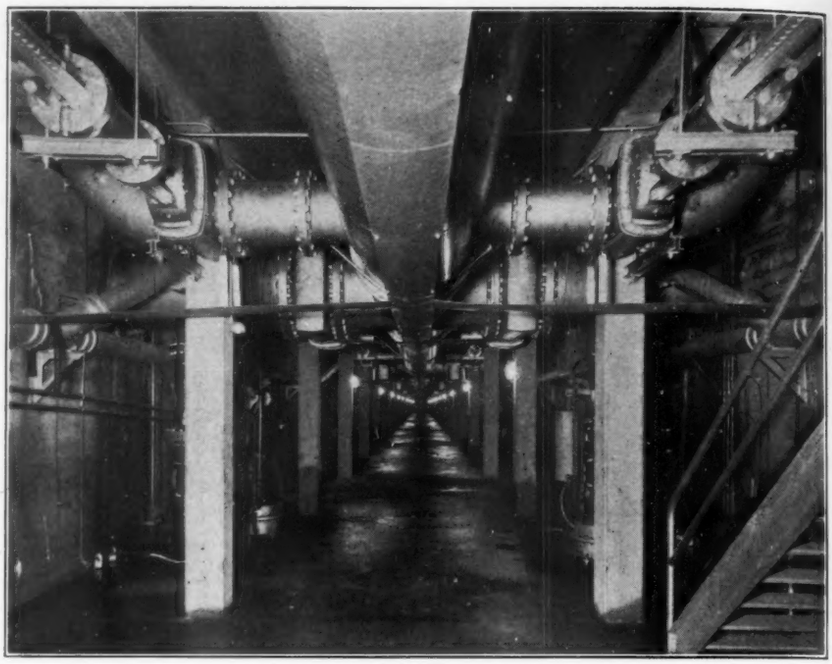


Fig. 2—The Center Pipe Gallery

Showing accomplishments with effective lighting in combination with aluminum paint.

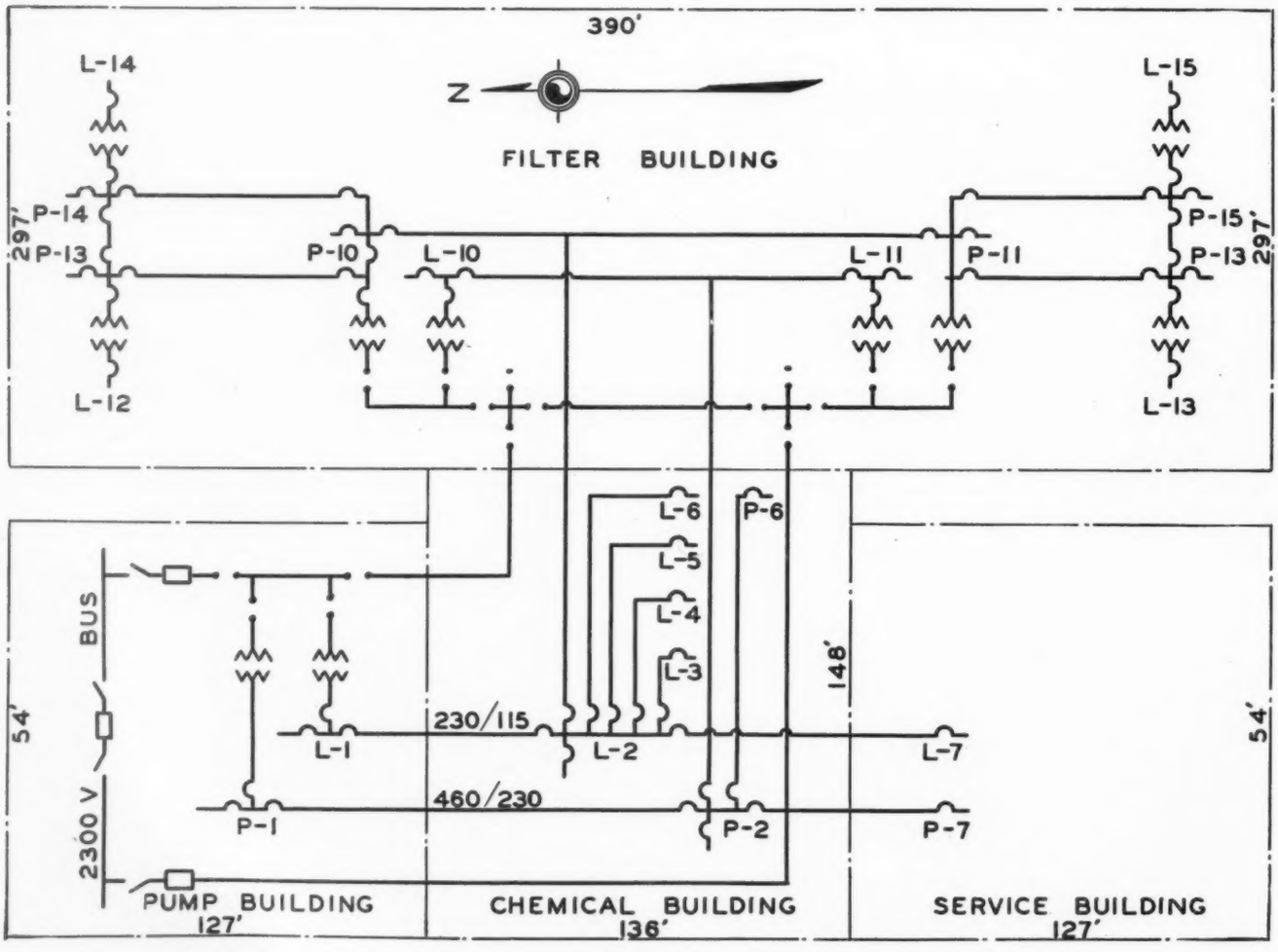


Fig. 3—Feeder and Distribution Wiring Diagram of the Plant

Showing arrangement of dual 2300-volt feeders to transformers and subsequent distribution. Power can be taken from either or both feeders.

Lighting Circuits

Lighting circuits are 3 wire, single phase, 230/115 volt. No wire smaller than No. 14 was used and wire larger than No. 10 is stranded. Conductors in dry location are insulated with standard double braid, 30 per cent rubber covered, NE code, 600 volt. Conductors in damp location are insulated with 30 per cent new rubber in lead sheath, conforming to NE code 600 volt. All conductors are run in hot dipped galvanized rigid conduit. Junction and outlet boxes are of plated cast iron.

Switching of the lighting circuits in the aisles and galleries of the filter building is accomplished through a number of contactor circuits. Each circuit includes a number of contactor switches having two normally open contacts which are used to control a mechanically held contactor, which in turn controls a group of lighting circuits. Each group of lighting circuits can be either fully or partially set up at the distribution cabinet so that all or any part of each group of circuits are controlled by the contactor. The arrangement facilitates lighting at predetermined levels of intensity to be turned on ahead and turned off behind when moving along any route through the filter building or pipe galleries.

Switching of lighting circuits in the lobbies and pump room is accomplished with nofuse breakers in the distribution cabinets. The lighting circuits are arranged so that illumination at intermediate levels of intensity having reasonably uniform distribution can be obtained.

The illumination of the filter beds is particularly successful, as the accompanying picture reveals (see Fig. 1). The operators are able to see down through the water to the top of the sand before starting to wash and are able to see the sand surface again as the water begins to clear. The lights are placed at such a position and angle that no glare or images are visible from any point near the operating table. Normally, when artificial illumination is required, the lights are turned on slightly before starting to wash and turned off shortly after finishing the wash so the expense of operating the unusually large units installed (see table) is of no great consequence when compared with the advantages obtained. The indirect illumination of all of the filter gauges, recording meters, and valve indicators also contribute to the ease and certainty of better operation and comfort of the operators.

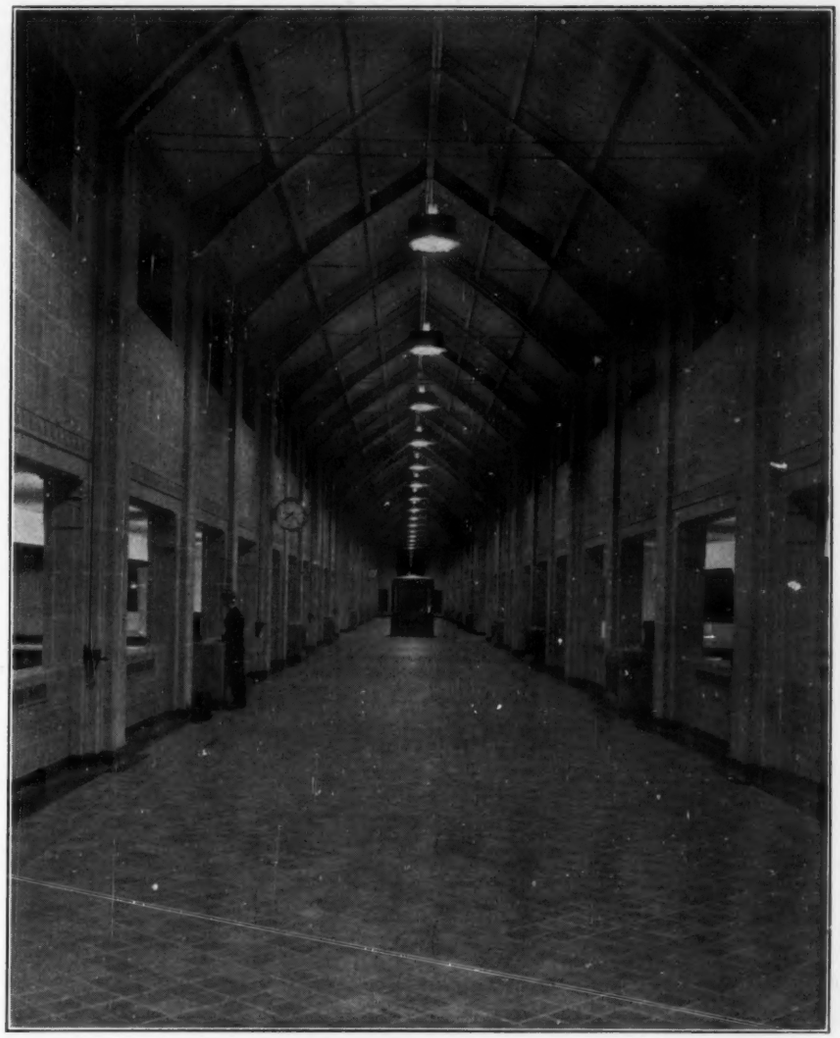


Fig. 4—Main Operating Aisle
On both sides the filter flood lights are on. Unfortunately the effect in this picture is to dim gallery somewhat.

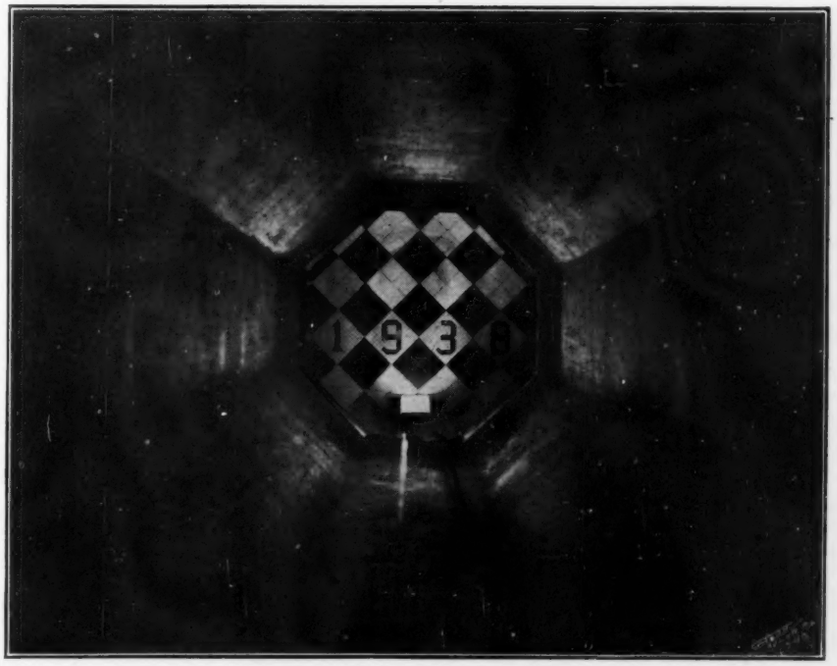


Fig. 5—The Observation Well
Always attractive to visitors and an incentive to operators.

CHEMICAL BUILDING

Location	No. Required	Manufacture	Type	Lamp No. Watt	Reflectors and Glass
Front entrance	2	Gezelschap & Sons	Exterior standard	1-300	.....
Rotunda	1	Gezelschap & Sons	36″ pendent	2-500	Holophane 6552 Alzack-Tuflex
Main and side lobby	9	Gezelschap & Sons	24″ pendent	2-500	Holophane 6552 Alzack-Tuflex
Supervision gallery	2	Gezelschap & Sons	Direct ceiling	2-75	Alzack-Tuflex
Lecture room	8	Curtis Lighting Co.	Indirect pendent	1-300	Alzack
Superintendent's office	4	Gezelschap & Sons	Semi indirect	1-300	Holophane 7344
Asst. superintendent's office	4	Curtis Lighting Co.	Indirect pendent	1-500	Alzack
Maintenance engineer office	4	Curtis Lighting Co.	Indirect pendent	1-500	Alzack
Clerk's office	4	Gezelschap & Sons	Semi indirect ceiling	1-300	Holophane 7344
Wash room lobby	2	Gezelschap & Sons	Ceiling	2-50	.....
Entry	1	Gezelschap & Sons	Semi indirect ceiling	1-150	Holophane 7344
Women's toilet	1	Gezelschap & Sons	Direct ceiling	1-150	Holophane 2328
Engineers' toilets	2	Gezelschap & Sons	Direct ceiling	1-100	Holophane 2328
Men's toilets	2	Gezelschap & Sons	Direct ceiling	1-100	Holophane 2328
Chemists' toilet	1	Gezelschap & Sons	Direct ceiling	1-150	Holophane 2328
Chemists' toilet	1	Gezelschap & Sons	Wall bracket	1-60	Holophane 2208
Passage No. 1	2	Gezelschap & Sons	Ceiling	2-50	.....
Entry and woman's	2	Gezelschap & Sons	Ceiling	1-60	Holophane 2208
Lobby El. + 31	2	Gezelschap & Sons	Direct ceiling	2-75	Alzack
Coal room	2	Gezelschap & Sons	Semi direct	1-200	Holo Controlens
Chemist office	4	Gezelschap & Sons	Semi direct	1-300	Holophane 7344
Bact. Lab.	9	Gezelschap & Sons	Semi direct	1-200	Holo Controlens
Passage No. 2	2	Curtis Lighting Co.	Indirect pendent	1-200	Alzack
Media room	2	Curtis Lighting Co.	Indirect pendent	1-300	Alzack
Chem. & Res. Lab.	10	Curtis Lighting Co.	Indirect pendent	1-500	Alzack
Exterior clock	1	Curtis Lighting Co.	Outdoor floodlight	1-1000	.....
Front basement	6	Crouse Hinds	V Form 200	1-150	.....
Center aisle and basement	9	Holophane	02368	1-150	.....
Passage El. + 7.00	2	Crouse Hinds	V Form 200	1-150	.....
Oil, battery, and wash rooms	5	Holophane	02368	1-150	.....
Stair hall north	1	Holophane	02480	1-200	.....
Stair hall north	2	Holophane	2470	1-150	.....
Stair hall center	8	Holophane	02208	1-60	.....
Stair hall center	5	Holophane	02328	1-100	.....
Stair hall center	1	Crouse Hinds	V Form 100	1-60	.....
Main men's wash room	2	Holophane	02378	1-200	.....
South basement	6	Holophane	02368	1-150	.....
Boiler room	2	Holophane	685 AL	1-500	.....
East basement	5	Holophane	02368	1-150	.....
Entrances	4	Holophane	830	1-150	.....
Receiving rooms	7	Holophane	02368	1-150	.....
Telephone switch room	2	Holophane	02208	1-60	.....
Janitors room	1	Holophane	02378	1-200	.....
Janitors room	1	Holophane	02328	1-100	.....
Chl. and Amm. scale rooms	24	Holophane	02368	1-150	.....
Chl. and Amm. control rooms	8	Holophane	02480	1-200	.....
Chl. and Amm. control rooms	2	Holophane	02470	1-150	.....
Meters and employees room	2	Holophane	02490	1-300	.....
Wash room	1	Holophane	02480	1-200	.....
Wash room	1	Holophane	02328	1-100	.....
Attendants room	1	Holophane	02490	1-300	.....
Storage El. + 31	2	Holophane	02208	1-60	.....
Chemical feed rooms	6	Holophane	652 VP	1-300	.....
Chemical feed rooms	8	Holophane	02368	8-150	.....
Large indicating meters	2	Bailey Meter Co.	.....	14-25	.....
Incubator	1	Holophane	02328	1-100	.....
Bag storage 43.5	4	Holophane	02368	1-150	.....
Bag storage 43.5	1	Crouse Hinds	V Form 100	1-100	.....
Bag storage 54.5	4	Holophane	02368	1-150	.....
Bag storage 54.5	1	Crouse Hinds	V Form 100	1-100	.....
Bag storage 65.	4	Holophane	02368	1-150	.....
Bag storage 65.	2	Crouse Hinds	V Form 100	1-100	.....
Conveyor room	10	Crouse Hinds	V Form 100	1-100	.....
Pent house	1	Crouse Hinds	V Form 100	1-100	.....
Tower room	4	Holophane	691 -AL-VP	1-500	.....
Tower room	1	Crouse Hinds	VD Form 100	1-100	.....

FILTER BUILDING

Location	No. Required	Manufacture	Type	Lamp No. Watt	Reflectors and Glass
Main entrances	10	Gezelschap & Sons	30" Bronze brackets	200	.....
Gallery entrances	8	Gezelschap & Sons	24" Bronze brackets	200	.....
Main and operating aisles (Fig. 4)	48	Gezelschap & Sons	.....	500	Holophane 6691
Service aisles	48	Holophane	02368	1-150	.....
Filter beds (Fig. 1)	64	Holophane	699	1-1000	.....
Observation well (Fig. 5)	1	Westinghouse	WS-8 No. 787103	1-250	.....
Transformer vaults	2	Crouse Hinds	V Form 200	1-100	.....
Center pipe gallery (Fig. 2)	17	Holophane	02368	1-150	.....
Center pipe gallery stair wells	6	Crouse Hinds	V Form 200	1-75	.....
E + W pipe galleries	52	Crouse Hinds	V Form 200	1-100	.....
E + W pipe galleries	52	Crouse Hinds	V Form 200	1-150	.....
E + W pipe gallery stair wells	8	Crouse Hinds	V Form 200	1-75	.....
N + S pipe gallery	28	Holophane	02368	1-150	.....
Pipe gallery pilot lights	6	Crouse Hinds	V Form 200	1-60	.....
Large indicating meters	7	Bailey Meter Co.	.....	14-25	.....
Rate controller—Rec. meters	32	Simplex V & M Co.	.....	2-25	.....
Operating table—Indicators	192	Pitt Construction Co.	.....	1-6	Aluminum

PUMP BUILDING

Location	No. Required	Manufacture	Type	Lamp No. Watt	Reflectors and Glass
Ceiling—Center	3	Holophane	692 AL	1-1000	.....
Ceiling east and west	8	Holophane	691 AL	1-1000	.....
Under El. + 1.5	4	Crouse Hinds	VC-Form 200	1-150	.....
Valve chambers	3	Crouse Hinds	V Form 200	1-150	.....
Switch rooms	6	Crouse Hinds	VJ Form 200	1-150	.....
South entrance	1	Holophane	H 739 SE	1-150	.....
N. E. entrance	1	Holophane	830	1-150	.....
N. E. entrance	1	Holophane	W-796-1	1-100	.....
Substation	5	Holophane	043384	1-300	.....
Switch board	..	Allis Chalmers	All instruments and meters are of the illuminated type		
Pump operators desk	1	Curtis Lighting Co.	CurtiStrip	.....	.....

GATE HOUSE

Location	No. Required	Manufacture	Type	Lamp No. Watt	Reflectors and Glass
Entrance	1	Holophane	830	1-150	.....
Above El. + 13.0	3	Holophane	02368	1-150	.....
Below El. + 13.0	3	Crouse Hinds	V Form 100	1-100	.....

SERVICE BUILDING

Location	No. Required	Manufacture	Type	Lamp No. Watt	Reflectors and Glass
Basement	14	Crouse Hinds	V Form 200	1-150	.....
Bag storage chemical unload	6	Holophane	02378	1-200	.....
Passage and park equipment	3	Holophane	02368	1-150	.....
Weigh master and hall	3	Holophane	02328	1-150	.....
Lavatories	2	Holophane	2208	1-60	.....
Machine shop	12	Holophane	685	12-300	.....
Shops	9	Holophane	HOSE 100	1-150	.....
Shops	9	Holophane	HOSE 200	1-200	.....
Entrances	4	Holophane	832	1-200	.....

The pipe galleries are provided with sufficient general illumination for all operating requirements and have plenty of electrical outlets to facilitate maintenance work. (See Fig. 2.)

The appearance of and the illumination produced by the aisle and lobby lighting fixture does justice to these interiors. (See Fig. 4.)

The illumination of the observation shaft provides the operators and public with an excellent means of visually inspecting the quality of water being produced. (See Fig. 5.)

In the pump room the illumination is well distributed in the working area around the pumps and switchboard. With all units on, 15 foot candles at the working level are obtained.

For its possible value to readers of this magazine, a somewhat detailed list of the lighting fixtures is shown in tabular form for each building. The lighting fixtures direct and spread the light efficiently in each instance. The light intensity for each purpose is believed to be generous.

In conclusion, if the reader is interested in additional illustrations showing lighting fixtures or information regarding this plant, other than details concerning illuminating design, he is referred to articles appearing in "Water Works and Sewerage," April and May, 1940, by Mr. J. P. Schwada, City Engineer.

THAWING SERVICE LINES AND SMALL MAINS ELECTRICALLY

Some Notes on Equipment and Suggested Procedure, with Compilation of Some Useful Data

By FRANK C. AMSBARY, Jr.
Superintendent
ILLINOIS WATER SERVICE CO.
CHAMPAIGN, ILLINOIS

THE following review of factors entering into the problem of thawing water service pipes is based upon the use of electrical energy derived either from transformers connected to convenient power lines, or the gasoline engine driven welders. These comments, suggestions and recommendations are being presented at the request of the editor of "Water Works and Sewerage." They are based on long experience by the writer's company with electrical thawing methods.

Selecting a Transformer

In the selection of a transformer for this purpose, two classes of equipment are available. The small portable transformer which is connected to the house electrical service lines and transformers which must be connected to the power company lines on the poles.

The Author

The small portable transformers with which we have had experience, due to the limited current carrying capacity of the electric service into the average residence, necessarily has a small output, resulting in limited applications and slow thawing. However, it is particularly suitable for thawing plumbing inside of structures or where only a short run of small pipe has been frozen, also for services of lead.

For all purpose use the transformer connected directly to the lines on the power company poles is usually the best. If this source of energy is chosen, suitable arrangements for the transformer, a lineman to make the primary connections, and a satisfactory energy charge can undoubtedly be made through the local office of the power company.

The power company should be cautioned to furnish a transformer with the *lowest voltage available on the secondary* to keep handling hazards at a minimum, and a current capacity of not over 200 amperes if the services to be thawed are of steel, wrought iron, lead, or cast iron, and not over 400 amperes if the services are of copper.

Our Combination Welder and Thawing Unit
Purchased for Thawing, and Use Also as a Welder, This Heavy Duty Unit Has an Output Range of 150 *to* 600 *Amperes at* 40 *Volts.*

Welding Generator Units

The gasoline engine driven welder is probably the most flexible unit available for thawing purposes. Being an entirely self contained unit, it is not dependent upon the necessity of an adjacent power line, and any intelligent employe can readily operate it. No lineman is required.

In the selection of a welder, it is suggested that the voltage be somewhere between the limits of 30 and 60, and if no copper pipe is used in the distribution system, the amperage be limited to 200 amperes. If copper pipe is likely to be encountered, the upper limit should be 400 amperes.

There is a considerable difference between the cost of a 200 ampere and a 400 ampere welder, and this difference in cost cannot be justified if there is no need of the larger currents.

All welders are equipped with controls to regulate the amperage, which readily adapts even the 400 ampere welder to any of the service materials in common use.

Suggested Current Rate for Various Materials

The following table showing the resistance and approximate melting points of the more common metals used in service lines, along with the suggested rate of current to be used for each, tells a comprehensive story of thawing in itself.

It is suggested that operators of the thawing equipment be furnished copies of this table to carry with them at all times, so each will be fully advised of the conditions that must meet on each job, by ready reference.

Metal	Ohms Per Milfoot*	Approximate Melting Point	Suggested Rate of Current
Copper	9.35	1900° F.	300 to 400 amps
Steel	63.00	2600° F.	200 amps
Wrought iron	82.80	2800° F.	200 amps
Lead	123.00	625° F.	75 to 150 amps
Cast iron	684.00	2500° F.	75 to 150 amps

*Resistance in piece of metal which is .001 inch in diameter and 1 foot long.

The smaller the value in ohms per milfoot, the higher the rate of current required to produce sufficient heat to melt the ice. For this reason the highest rates are recommended for copper. Due to the high resistanc of lead and cast iron, lesser rates will accomplish the desired results in a reasonable time and *in all cases the smallest rates compatible with time* should be used to eliminate dangers always present when large currents are used.

The melting point of the metal of the more generally used materials found in service construction is included in the above table to suggest the danger of melting lead service pipes. It will be noted that lead, which has the lowest melting point, also ranks next to the highest in resistance. To prevent over-heating and melting of lead, the low rates must be used. It follows that the 75 to 150 amperes which is recommended for lead will thaw a service of this material in a reasonable period of time, while if this same rate is used on copper, due to its low resistance, the heat generated will be negligible.

Rates recommended for lead should be used where lead goosenecks are used regardless of the material used in the balance of the service. Lead joints in cast iron pipe must likewise be protected by the use of small rates.

Time Required Depends Upon Current

The period of time required to thaw a service is inversely proportional to the *square* of the current. For example, with a one-half inch service, if it requires 10 minutes to thaw at 200 amperes, it will require 40 minutes at 100 amperes.

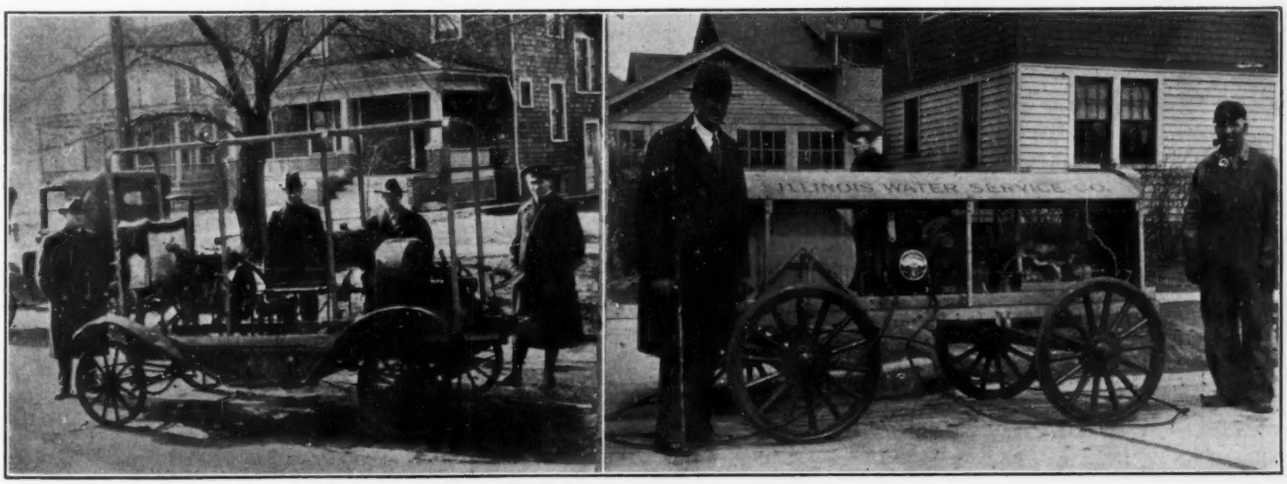
Regardless of the number of services waiting to be thawed, *time should be secondary to safety*; and, for safety, the rates recommended in the table should not be exceeded.

Wire Size Important Also

The following table gives safe current carrying capacity for the leads from the source of energy to the pipe to be thawed. It is assumed that the length of such lead wires will be kept at a minimum.

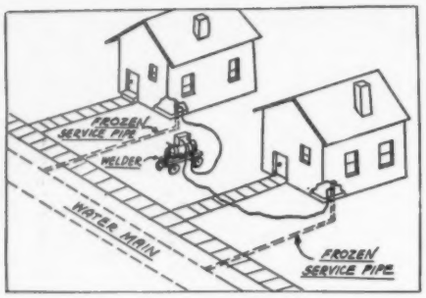
Size Wire B & S	Safe Current Carrying Capacity*
0	200 amps
00	225 amps
000	275 amps
0000	325 amps

*For short periods of thawing twice these rates of flow may be safely employed.



Other Equipment We Have Known

(Left) Our First Electrical Thawing Machine of 1918 *Consisted of Parts From a Junked Metz Automobile and a Used Generator. (Right) Our* 1929 *Model Seemed Very Dressy at the Time. It Was Also Constructed in Our Shop From an Automobile Engine. In* 1936 *We Turned Out One With a New Ford Engine and Spiffy Pneumatic Wire Wheels.*



Suggested Thawing Hook-Up
By This Arrangement Two Services Can Be Thawed at One Operation. If Only One Service Is to Be Thawed, One Wire (Either One) May Be Connected to a Fire Plug. Before Turning on the Current It Is Important to Disconnect the House Piping From the Service Lines.

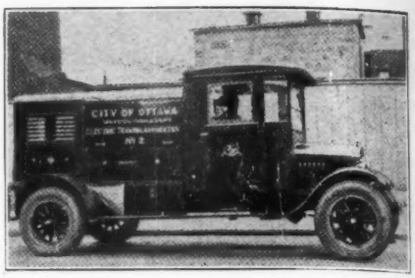
Procedure and Precautions:

The following example for thawing a frozen service is based upon the assumption that meters are set in the basement, and the thawing circuit is closed by connecting one wire from the source of energy to the frozen service pipe in the basement and the other wire to the service pipe in the adjacent house (see sketch); also that a good quality C clamp, or similar appliance for making the electrical contact to the pipe, is used. It is recommended that a solderless lug be clamped on the end of the wire and then securely bolted to the C clamp.

First remove the meter in each basement or in some way break all connection between the house piping and the line to be thawed. Remember that in thawing services one is dealing with a current that in some cases is as high as 40 times the average lighting demand of a home. Due to grounding of house lighting circuits to water pipes, if the meters are not removed, or some other break made in the line, the current used in thawing the service may feed back into the light circuit and cause serious damage. Houses have been burned down due to such a condition. Another source of feed-back is through the water heater to the gas line, which may melt the lead gaskets in the gas meter.

Special care should be exercised to see that all rust, scale, grease, etc., is removed from the pipe at the point where the C clamp is fastened to the pipe. Unless a good contact is made, arcing is likely, which may cut holes completely through the pipe. Poor connections also waste electrical energy and slow up thawing.

The connections now having been made to both services, thawing may be started. Do not make the common mistake that has caused trouble by assuming the removal of the meters will eliminate all sources of feed-back from the thawing circuit. Water pipes may make contact underground with the gas distribution system and thus feed-back into the house. During the entire period of thawing constant check on the gas pipes in both houses should be made, as well as to adjacent properties that are entirely out of the circuit established for thawing. Lead gaskets in gas meters have been melted out in the basements of homes not included in the thawing circuit. Continually check connections and joints in the circuit to see that they are not overheating.



A Unit of Ottawa's Thawing Fleet

Some Final "Dos and Don'ts"

(1) Use the smallest current possible to accomplish the job; do not hurry by using large currents.

(2) Be sure of good electrical contact from source of energy.

(3) Be sure your wires from the source of energy are adequate.

(4) Be sure that you know the material used in the service and adjust the current used accordingly.

(5) Be sure to check for any feed back of the current used in thawing through the gas service. Any heat detected by placing the hand on the gas meter couplings will immediately indicate such a condition.

Polarity does not really make much, if any, difference in the efficiency of the circuit.

But—NEVER FORGET THAT IN THE USE OF LARGE CURRENTS IT ALWAYS PAYS TO BE CAUTIOUS!

A BOTTLE HOLDER

By FRED E. SMITH

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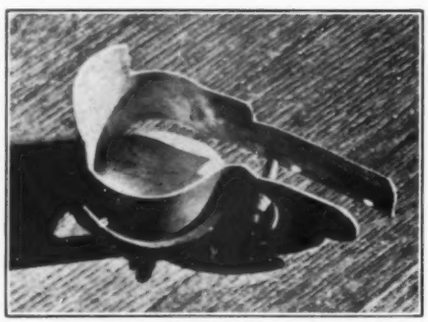
Cambridge, Mass.

The collection of water samples from flowing streams often presents difficulties, especially in connection with the sample for bacteriological examination. The analyst often must stand on wet rocks or slippery stream banks in order to fill the bottle. If bushes are growing at the water's edge, one is limited in the extent of reaching a sufficient distance over the water to fill the bottle at the selected spot.

In an attempt to surmount the difficulties encountered in collection of samples in the field, a bottle holder was developed in this laboratory. The photographs illustrate details of the holder. It was formed with a single piece of metal, sheet aluminum 3/32" thick. The dimensions are approximately 4" in length and 1½" diameter in the bottle compartment. After cutting the pattern from the metal sheet, the circular bottom was bent upward and rounded to enclose the bottle. The end of the longer arm was half-



rounded and drilled to be fastened to a wooden handle, which may be of any desired length. Through the handle and holder arms is inserted a small bolt with wing-nut. This enables the holder to be tightened around the bottle, securing it in place. The bolt also provides additional support between the handle and holder.

It will be noted that the bottle is held in position at a 90° angle to the holder. This enables approved technique to be used by forcing the bottle through the water when collecting a sample from a flowing source. The holder bottom will prevent the bottle slipping from the apparatus during sampling.

The holder has been successfully used in the collection of samples from streams, reservoir surfaces, and wells. If in the field the handle is not long enough for the desired purpose, a stick may be tied to the handle for an extension.

The apparatus is not difficult to construct, is inexpensive, and may be adapted to any desired dimensions. It should find useful application in the collection of samples from many sources.

SOLVING THE PROBLEM OF BILLING FOR SEWAGE DISPOSAL*

By H. F. SMITH
Senior Administrative Assistant
DEPARTMENT OF WATER SUPPLY
DETROIT, MICHIGAN

The Author

FOR the purpose of this discussion, let us assume that this problem begins after decision has been made to distribute the expense of building and operating a sewage disposal system among the users of the system, on the basis of the extent, or presumed extent, to which each uses the system. This basis of distributing the expense is frequently referred to as the utility basis or the sewer rental charge basis, as opposed to the method of spreading the expense on the general tax rolls.

The problem of billing for sewage disposal on the sewer rental basis is not *a* problem but a series of problems, in fact, several series of problems. It is the purpose of this paper to consider in detail only that series which relate to the practice of billing for sewage disposal on the basis of water consumption and to report the experience of the City of Detroit with these problems, rather than to discuss each abstractly or as they might apply under all the various sets of circumstances brought about by varying local conditions.

This discussion, therefore, resolves itself into a consideration of the following questions:

1. What is the most satisfactory basis for sewer rental charges?

2. What is the most desirable rate structure?

3. In what form is the sewage disposal charge to be billed?

4. How are sewage disposal revenues and receipts to be segregated from water revenues and receipts?

5. Who is to be held responsible for payment of sewage disposal charges?

6. What is the most satisfactory means of forcing payment of sewage disposal charges?

7. What effect will adding sewage disposal charges to water bills have on water bill collections?

8. What is the most satisfactory method for billing users of the sewage disposal system who obtain all or part of their water supply from a source other than from the city's regular water system?

9. What are the special problems that arise in connection with billing for sewage disposal service rendered to suburban communities?

10. What kind of an adjustment should be made for water used in such a manner and for such purposes as to exclude the possibility of its returning to the sewage system?

While these problems are in most cases general to all cities or jurisdictions which are concerned with the question of sewage disposal billing, there is such a wide variation in local conditions as related to laws, policies, habits, and available equipment that there is no reason to believe that there can be any general agreement on the answers to all of these ten separate problems. With this in mind let us now consider each of these several problems one at a time.

1. What Is the Most Satisfactory Basis for Sewer Rental Charges?

There are several different bases available, the most frequently used of which are:

a. A uniform charge to each user of the system.

b. The number of sewer connections.

c. The type of property served.

d. The number of plumbing fixtures.

e. Metered water consumption.

f. Metered sewage.

It appears to be quite generally accepted, however, that *metered water consumption is the one most satisfactory yardstick* for estimating sewage flow and, therefore, service to the sewer user.

Detroit officials were in agreement on this point and because Detroit's water system is 100% metered, water consumption was adopted as the base for sewage disposal charges, with the understanding that other measuring sticks were to be applied in cases where a private water supply is involved, and special consideration would be given to cases where all or part of the metered water is not discharged into the sanitary sewer.

2. What Is the Most Desirable Rate Structure?

Assuming that metered water consumption is to be the base, there are three sewage disposal rate structures to choose from:

a. A uniform rate per thousand cubic feet of water consumed.

b. A step rate.

c. A uniform per cent of the water bill.

Detroit adopted the uniform rate per thousand cubic feet for the reason that the entire charge is for treatment and disposal of sewage that is picked up by the interceptor; consequently the cost of treating and disposing of any given unit of sewage is practically identical to the cost of treating and disposing of any other unit. There is, for example, no difference in the cost of treating and disposing of one million gallons of sewage contributed to the system by one large contributor, and the cost of treating and disposing of the same quantity contributed to the system by 1,000 contributors who contributed 1,000 gallons each. *Factors involved in a water rate study are entirely different in many respects.* Certainly no one will contend that it does not cost more to deliver 1,000 cubic feet of water to each of 1,000 customers than it does to deliver the total amount to one large customer. That is the reason for steps in a water rate. These reasons, not being present in the Detroit sewage disposal rate problem, it would be difficult to justify the use of the "step rate" or the "per cent of water bill" plan.

3. In What Form Is the Sewage Disposal Charge to Be Billed?

The available choices are:

a. Separate bill entirely independent of water bill.

b. Separate bill attached to water bill.

c. Billed as a separate item on the water bill.

d. Included in the water bill.

There are advantages and disadvantages to each method. We feel, however, that the advantages of separate bills or separate items on the water bills are insufficient to justify

* A paper presented before the 1940 Public Works Congress of the Am. Public Works Association.

the additional expense caused thereby.

A cost study of the various procedures disclosed the fact that it would cost the Detroit Water Department an additional sum of approximately $40,000 a year to show the sewage disposal charge as a separate item on the water bill, or an additional sum of about $75,000 a year to render separate bills; whereas, under the adopted plan of including the sewage disposal charge in the water bill, there is not one cent additional expense involved.

4. How Are Sewage Disposal Revenues and Receipts to Be Segregated from Water Revenues and Receipts?

Under the separate bill plan, separate ledger records are usually maintained, thereby establishing an entirely independent set of records for sewage disposal; consequently this question does not arise. Under the "separate item on bill plan" there are several satisfactory methods. These are, of course, dependent upon the kind of customer accounting system used by the water department.

Where the sewage disposal charge is included in the water bill, there is a real problem. Here is how Detroit solved it. A glance at the rate structure here shown will help to clarify this picture.

It will be noted that the rate schedule shows the water rate separately, the sewage disposal rate separately, and then the combination rate which is, of course, the sum of the two. The customer service staff think and talk in terms of two separate rates; whereas, the billing and bookkeeping staff think only of the combined rate. Their operations have not changed one bit. The addition of the sewage disposal charge to them is simply a change in the water rates. It should also be understood that Detroit's regular water billing control system has always given the exact amount of water billed, both in dollars and cubic feet per billing unit. These unit totals are summarized to district, daily, and monthly totals; consequently, there is available for any given period of time or geographical subdivision of the area served by the system, an accurate statement of the amount of water consumed. In view of the fact that the sewage disposal rate comprises a flat 11c per thousand cubic feet of water consumed, it is only necessary to apply the sewage disposal rate to the total amount of water billed for any given period or district to determine the exact amount which was charged for sewage disposal. This amount deducted from the total amount billed does, of course, give the amount billed for water.

An entirely separate set of general books is kept for sewage disposal records, in accordance with provisions of the state enabling act and the city ordinance. Sewage disposal billings and water billings are entered to the revenue accounts in their respective ledgers while the total of the two is posted to accounts receivable in the water ledger, with an entry to accounts payable in an amount equal to the total sewage disposal billing and a corresponding entry to sewage disposal accounts receivable. All cash receipts are therefore credited to water — accounts receivable. This method of accounting was adopted in order to avoid the necessity of segregating cash as received. Therefore, *segregation is made on the basis of revenues rather than cash receipts* but the two are brought into exact agreement in the following manner:

The Department of Water Supply knows from past experience that it is eventually going to collect all but about two-tenths of 1% of the amount it bills; consequently it is willing and does withdraw cash each month from the water fund in the amount of the total sewage disposal charges billed for the month, and deposits such amount to the credit of the sewage disposal fund with the understanding that any delinquent balance later written off as uncollectible will be analyzed to determine what part is for water and what part for sewage disposal, and that the amount for sewage disposal will be transferred from the sewage disposal fund to the water fund, thus bringing the segregation of funds which was made on the basis of revenue into complete and exact agreement with segregation on the basis of cash receipts. It may be pointed out that this plan causes the Water Department to make advance payments to the sewage disposal fund. To a certain degree that is true, but if this procedure should for any reason become undesirable, payment can be delayed a few days, so that on the average there would be no advance payment. In any event, we think that this point is immaterial when considered with the fact that this method of billing means a net savings of about $75,000 a year to users of the sewage disposal system.

5. Who Is to Be Held Responsible for Payment of Sewage Disposal Charges?

It is, of course, important to determine in advance who is to be held responsible for sewage disposal charges and what method is to be

DETROIT WATER AND SEWAGE DISPOSAL RATES

Effective On All Bills Rendered On and After June 19, 1940

Rate Steps	Water Rate Per M. Cu. Ft.	Sewage Disposal Rate Per M. Cu. Ft.	Total Rate Per M. Cu. Ft.
Consumption Charge—			
First 10,000 cu. ft. per month.....	78c	11c	89c
Next 90,000 cu. ft. per month.....	60c	11c	71c
All over 100,000 cu. ft. per month.....	48c	11c	59c

MONTHLY SERVICE CHARGE

Meter Size	Water Rate Per M. Cu. Ft.	Sewage Disposal Rate Per M. Cu. Ft.	Total Rate Per M. Cu. Ft.
⅝ inch	$ .24	....	$ .24
¾ inch	.36	....	.36
1 inch	.72	....	.72
1½ inch	1.44	....	1.44
2 inch			
3 inch	3.36	....	3.36
4 inch	4.32	....	4.32
6 inch	7.20	....	7.20
8 inch	11.04	....	11.04
10 inch	15.84	....	15.84
12 inch	18.72	....	18.72
16 inch	30.24	....	30.24
24 inch	53.28	....	53.28

Service Charge is added to Consumption Charge and shown on the bill as one item.

Minimum Bill.....$1.50 per quarter

FIRE LINE RATE

Consumption Charge plus one-third Service Charge.

This bill is for water and sewage disposal service to the premises designated on the face of the bill, and by virtue of the Detroit City Charter and Ordinances is a lien against the property served.

used to establish such liability. If the charge is based on water consumption, the responsibility for payment of the sewage disposal charge should be the same as the responsibility for payment of the water charge and established in the same manner. If water is furnished on an individual contract basis, the contract should be revised to include sewage disposal charges. If, by city charter or ordinance provisions, water charges are made a lien against the property served, then the sewage disposal ordinance should provide for making sewage disposal charges also a lien against the property, and *care should be taken to see that the provisions conform in all essential details.* In Detroit, both water and sewage disposal charges are made against the property served. Such charges are held a lien against the property by virtue of a state law and city ordinance.

6. What is the Most Satisfactory Means of Forcing Payment of Sewage Disposal Charges?

There are a number of possibilities, the principal ones being:

a. The right of lien on the property
b. The right to turn water off.
c. The right to disconnect the sewer.
d. Civil suit.

While the right of lien is a formidable weapon for use against delinquent customers, it is a most cumbersome and costly one, because of the expense of foreclosure which usually exceeds to a considerable extent the ordinary sewage disposal or water charge. Its principal value lies in its ability to fix responsibility, but depends largely on some other agency to actually force collection.

The perfect combination is the right of lien to establish liability and the right to discontinue sewer service and/or water service to the property for nonpayment of the sewage disposal charge. The Detroit ordinance provides for all of these measures and also includes the "right to sue."

[Since this article was prepared an Ohio court has ruled that the City of Mansfield had the right to cut-off water service in order to enforce collection of delinquent sewer rental charges, even though the water bills were not delinquent.—Ed.]

7. What Effect Will Adding Sewage Disposal Charges to Water Bills Have on Water Bill Collections?

This is a question that has disturbed the management of many water departments. Such meager reports as have been available seem to indicate that the seriousness of this question is probably being overrated. Detroit's experience on this point has not been of sufficient duration to make possible any definite conclusions. However, it is believed that experience thus far gained is indicative of what the final outcome will probably be. Detroit's total delinquent balance of its 300,000 water accounts stood at $108,000 on May 31. Most of this balance is represented by current charges. Then the practice of adding sewage disposal charges to water bills was commenced, so that by August 31 all accounts had been billed for the combined charge. During the three-months' billing cycle of May 31 to August 31, water sales increased 4 per cent, while the addition of sewage disposal charges accounted for an increase of 12 per cent, for a total of a 16 per cent increase to sales, whereas during the same period the delinquent balance increased only 8 per cent. These figures seem to indicate that Detroit's collection picture is some better after the first cycle of sewage disposal billing than it was before. If this is true, it is, of course, not because of the addition of sewage disposal charges but in spite of them and probably due to improved business conditions. This experience, however, together with our observation of general customer reaction to this charge during the last three months, leads us to believe that the addition of sewage disposal charges to water bills does not necessarily have any detrimental effect on collection of water bills.

8. What is the Most Satisfactory Method for Billing Users of the Sewage Disposal System Who Obtain All or Part of Their Water Supply From a Source Other Than From the City's Regular Water System?

Detroit has not yet completed its study of this problem so can not report its experience. Progress made thus far, however, indicates that there are no insurmountable obstacles in the way of a satisfactory solution. The city ordinance provides:

> ". . . Charges against property served and/or users within the corporate limits of the City of Detroit, including manufacturing and industrial plants, obtaining all or a part of their water supply from sources other than the City's water system shall be determined by gauging or metering, in a manner approved by the City acting by and through its Board of Water Commissioners, the actual sewage entering said sewage system or the corresponding water use. Meters or other means for gauging or metering as above provided shall be installed by the property served and/or the user of the sewage disposal system as required by and under the supervision of the Board of Water Commissioners of the City of Detroit, as a condition to the use of said sewage disposal system. It is hereby determined that such meters or other method of measurement is required to provide for the proper operation of the system and disposal of sanitary sewage and other waste in the interest of public peace, health and safety, and the same shall be installed within thirty (30) days after written notice by the Board of Health of the City of Detroit so to do, shall have been served upon the owner of the property and/or the user of the sewage disposal system or posted upon the premises.
>
> "Any violation of or failure to comply with the foregoing provisions of this ordinance shall be punishable by a fine of not to exceed five hundred ($500) dollars and costs; and in the imposition of any such fine and costs the Court may make a further sentence, that in default of the payment thereof, within a time to be fixed in such sentence, the offender be committed to the Detroit House of Correction for any period of time not exceeding ninety (90) days. . . . "

9. What Are the Special Problems That Arise in Connection With Billing for Sewage Disposal Service Rendered to Suburban Communities?

There is probably no semblance of uniformity between various cities in the problems that arise from this source. In Detroit, the situation is rather involved. Eighteen suburban cities and villages receive their water supply from the Detroit water system through master meters. Approximately 9,000 properties in unincorporated suburban areas also are served by the Detroit water system. These through individual meters. Only two of the suburban cities that use Detroit water are served by the Detroit Sewage Disposal System, while there are three cities which do not use Detroit water that *are* connected to the Detroit Sewage Disposal System. Likewise, only part of the suburban individuals who use Detroit water are served by the Detroit Sewage Disposal System, while other suburban individuals who do not take Detroit water or use the Sewage Disposal System. To further complicate matters, all of the suburban cities and most of the suburban individuals who use the Sewage Disposal System, have for many years prior to this been using the Detroit sewers, in accordance with the terms of separate contracts which provide for flowage rights and costs therefor, but which do not include provisions for treatment or cost thereof. In general, the answer to this problem has been to execute new

and uniform contracts for the use of the Sewage Disposal System and make necessary adjustments to the old contracts for flowage rights.

Rates offered another problem, in that a substantial portion of the construction of the Sewage Disposal System was financed directly, or indirectly, from City of Detroit general tax revenues to which suburban residents did not contribute; consequently, this fact had to be taken into consideration in the establishment of rates, with the result that the suburban Sewage Disposal rates per 1,000 cubic feet of water consumed is considerably higher than the city rate.

10. What Kind of an Adjustment Should Be Made for Water Used in Such a Manner and for Such Purposes as to Exclude the Possibility of Its Returning to the Sewage System?

This troublesome question is always present where metered water is used as the base for sewage disposal charges. The principal difficulty presented by this question is where to draw the line if adjustments are to be allowed for metered water which does not reach the sewer, since there is probably no consumer who does not use some water that is not discharged to the sewer. The class, therefore, runs the entire gamut from the customer who occasionally sprinkles his lawn to large industries who use substantial quantities of water in processing operations and where such water is eventually discharged, after serving its purpose, to some outlet which is not connected to the sewage disposal system, or where it is used as an ingredient of the firm's product, converted into steam, or placed in railroad locomotives which are about to pull out for points beyond the limits of the sewage disposal system.

There have been several methods tried for adjusting charges to meet this condition. These have met with varying degrees of success. The most frequently used method appears to be the use of the "deduction meter," a meter installed to register that part of the water which is used in such manner as to make its return to the sewer impossible or at least unlikely.

The disadvantage of this plan is that it is frequently difficult to draw a definite line between delivered water which does and does not reach the sewer, and even if it can be clearly segregated on paper, it is likely to be an expensive operation to rearrange the plumbing so that it will be possible to meter separately each kind of water service. The cost of the extra meter alone would practically bar its use on residential properties and even though all of these difficulties are met and the deduction meter finally installed to cover a certain section of the water system which has been separated and declared to be eligible for coverage by a deduction meter, there is no assurance that it is going to stay that way, as has already been discovered by some water departments.

Another plan in use to some extent on residential services is to base the sewage disposal charge for summer months on consumption of the preceding winter months on the theory that the higher consumption in the summer is due to lawn sprinkling. This plan would not be at all practical, as far as Detroit is concerned, for the reason that it is known that increased consumption in the summer is frequently due to causes other than lawn sprinkling, and further, there are many accounts whose winter water consumption is higher than the summer consumption. It would increase commercial costs considerably because of the many exceptions that it would cause to the regular billing routine. Beside all of these difficulties, this plan of adjustment apparently pre-supposes that meter reading periods are divided into four annual periods that conform to the seasons of the year. Such, of course, is not the case. In Detroit, for example, meters are read every day of the year on the cycle plan, so instead of four reading periods there are 365, each of which varies from the others in period covered by from anywhere from one to ninety days.

In connection with this question we should not lose sight of the fact that, regardless of the adjustment policy, a certain revenue must be realized from the application of the sewage disposal rate. The more water consumption that is declared exempt from the application of the sewage disposal rate, the higher the rate must be for the water that is subject to the charge. If this resulted in a rate increase only in the amount required to offset the revenue lost by "exemptions" it would not be so bad, for then it would simply be a change in the method of distributing a fixed expense. Unfortunately, however, all of the proposed adjustment methods cost money to operate; consequently the rate must be increased an additional amount to cover adjustment costs.

Obviously, the net result is, that while adjustments have been made for water that does not reach the sewer, the total bill for sewage disposal is higher than it would have been had no adjustment been made.

Because of the shortcomings of all the adjustment methods that so far appear to be available, Detroit has not yet adopted any. It began billing sewage disposal charges with water bills on June 19. Since then, every one of its 300,000 customers has been billed. To date there have been only nine requests for adjustment (this does not include counter inquiries and requests made by customers who withdrew their request after the department's explanation of the charge and the procedure relating thereto.) These nine customers are all large consumers and are cooperating splendidly with the department in an effort to find a satisfactory answer to this problem. They have paid the sewage disposal bills in full, subject to a final decision on the question of adjustment. A study of this question is now being made by the various city departments affected, with the assistance of the large water users concerned. Conclusions have not yet been reached.

We do not mean to imply that all water consumers in Detroit except the few above mentioned are delighted with the sewage disposal charge, as there are probably some that have not yet been heard from, but we are *very much pleased with the way that the citizens of this city have accepted this additional charge.* We think that the average resident realizes that construction of the Sewage Treatment Plant was necessary and that they are convinced that they may as well pay for it this way as any other. It is also our opinion that the reason that our citizens have accepted this additional charge so agreeably is *due to an effective, inexpensive publicity campaign* that consisted of getting to the consumers a frank statement of the facts by means of newspaper and radio announcements and a printed pamphlet which was delivered to each customer with his water bill.

In closing, I would like to express my appreciation to the staff of A.P.W.A. for the assistance rendered during our study of this problem and particularly for the advance copy of their publication "Sewer Rentals"* which we found to be of great assistance.

[*Copies of this compilation of statistics and methods of charging and billing for sewer service charges may be had for a very nominal price from the American Public Works Association, 1313 East 60th St., Chicago, Ill., or through "Water Works and Sewerage."]

SEWERAGE SERVICE LINES*

Commonly Termed the House Connection Sewer

By GEORGE W. SEELEY
City Engineer Manager,
TUCSON, ARIZONA

THE sewer from the house to sewer main often called the house connection sewer receives very little consideration, but is the cause of the majority of repairs and maintenance on an entire sewer system. If more care and attention should be given house connection sewers, most of the trouble caused can be eliminated.

The trouble that is most annoying and inconvenient to the owner is stoppages, of course. In the house sewer stoppages are most commonly caused by tree roots growing into the pipe; however, rough joints and bad pipe also add to this cause. Tree roots usually grow through faulty joints or cracks in the pipe, or through the walls of porous pipe. The earth that is excavated and backfilled in constructing a house connection sewer makes an ideal place for root growth. A hole in a pipe too small to be detected in a casual inspection will allow roots to enter. Once the root has penetrated the pipe it grows rapidly. The writer has seen root masses completely filling a sewer pipe for a length of thirty feet. Rough joints or rough pipe may cause rags or other solids to lodge and build up, eventually causing a stoppage. Insufficient slope on a house sewer, in connection with rough pipe or rough joints, tends to increase stoppages and allow a ring of grease and calcium soap to form. In some instances the hard soap and grease ring is a contributing cause for stoppage, in that the base of the pipe is markedly reduced.

Leaks in house connection sewers are another source of trouble. They may not be detected for a long period of time and, in some soils, they may never be detected. Leaks are caused by faulty joints and cracked pipe. A house connection sewer that has been tested and found watertight may later be broken by the weight of the earth on it if the bedding is faulty and settlement occurs.

Materials

The materials to be used in a house connection sewer should be carefully selected to fit the conditions as they exist. There are many good materials on the market, but some give better service in certain places than others. In some cases a high priced material is more economical than a lower priced material and vice versa. The minimum size of a house connection sewer should be four inches in diameter.

Cast iron soil pipe used for house connection sewers has proved very satisfactory. It resists corrosion from sewage and sewage gas, also resists corrosion from the large majority of soils in which it is laid. It has a high strength and shell thickness that prevents breaking in the majority of cases where the bedding settles. The cost of cast iron soil pipe varies with distance from the place of manufacture. Close to its place of manufacture it is competitive with most any other type of house connection sewer pipe.

Vitrified-clay pipe has proved satisfactory for house connection sewer in most cases. It resists corrosion due to acids and chemicals. It is most likely to be broken by the settlement of bedding than cast iron soil pipe. It is reasonably cheap; and since it is manufactured in many parts of the country, the freight rates are not usually excessive.

Cement-asbestos pipe, while claimed to be one of the oldest kind of pipe used, is more or less new to the sewer pipe field in America. It has been used in many places and favorable reports have been made concerning it.

Cement concrete pipe is but little used for house connection sewers. It is not resistant to acids, sewer gas and certain chemicals.

Fittings

Fittings for house connection sewers should be smooth inside and the bell and spigot made so that joints can be easily made that will have the same smoothness. Fittings that have sharp bends should be avoided. Wye fittings should be used where two lines join.

Where the pipe for the house connection sewer is vitrified clay tile, the fittings should be of the same material. Cast iron soil pipe fitting should be used with cast iron soil pipe.

Jointing Material

The most important part in the construction of a house connection sewer is the joint. The importance of the joints is frequently neglected. This neglect causes a large percentage of the trouble in the house connection sewer. There are several good jointing materials on the market which give excellent results when correctly used.

Portland cement grout is the material most commonly used with vitrified clay pipe. The Portland cement joints frequently crack allowing nearby roots to enter the pipe through the joint and cause trouble. The low first cost is its principal recommendation.

When cast iron soil pipe is used for house connection sewers, the usual method is to use jute and lead joints. Jute and lead make an excellent joint, provided the jute is well rammed home, the lead poured to the end of the bell and well caulked. A leaky lead joint will cause as much trouble as a leaky cement joint.

A very satisfactory joint may be made with jute and G-K compound. This material has been used satisfactorily on both cast iron soil pipe and on vitrified clay pipe. In making a joint with this material, the G-K compound should be melted and kept at the temperature recommended by the manufacturer. It is usually poured from a ladle similar to that used for making lead joints.

Many other jointing materials and joints are on the market. Where there is any doubt about the quality of a jointing material it should be tested under actual conditions.

Construction of the House Sewer

The location of a house connection sewer will in most cases be determined by location of the plumbing in the house to be served. It should wherever possible, run in a vertical plane from the house plumbing to the sewer main. In order to drain freely it must have a minimum slope of ¼ inch per foot. Where the main sewer is six to ten feet deep it is good practice to run the house con-

(*This article prepared at our request is based on a discussion of the same topic Mr. Seeley presented before the Arizona Sewage and Water Works Association, meeting in Tucson.—Ed.)

nection sewer on a ¼ inch to-the-foot slope to a point from which it can be run into the main sewer on a one-to-one slope. Where the main sewer is more than ten feet deep one method sometimes used, in order to save excavation, is to run the house connection sewer on a ¼ inch-to-foot slope and then drop vertically into the main sewer. This method has the disadvantage of impeding the flow in the sewer main and thereby reducing the carrying capacity of the main.

The excavation for the house connection sewer is made by either a trenching machine or by hand. If it is made by a trenching machine it is finished by hand to provide proper beddings.

When the pipe is laid, special attention should be given to making of the joints. The slope of the pipe should be carefully checked for sags and minimum slope. The bedding should be checked to see that the entire length of the pipe is firmly supported. As it is usually impossible to test the joint where the house connection sewer joins the main sewer, this joint should be made with great care and a wye in the lateral is usually the best means of making the connection. Connections may be made by cutting a hole in the main into which a bell fitting is placed. No portion of this fitting should be allowed to protrude inside the sewer main. This bell fitting should then be enclosed in a generous amount of Portland cement concrete. The house connection sewer should enter the main sewer in the upper 180° of pipe. This will prevent the slowing up of the flow where the main is only half full and also provide a smooth invert for solids to slide along on.

In backfilling a house connection sewer trench the earth replaced in the bottom twelve inches of the trench should be free of all rocks larger than one inch in any dimension. The bottom six inches of the fill should be well tamped taking care not to displace the pipe. The remainder of ditch should be backfilled using water or the vibration method for settling. The type of soil will govern the amount of water to be used but will have little effect on the vibration method.

Wyes in the Sewer Main

For many years it has been common practice to leave wyes in the main sewer where it was supposed a connection would eventually be needed. Experience has shown that many of these wyes were never used. Much labor has been used in finding these wyes, due to inaccurate record locations. Many times the wye was not placed so as to be convenient to the plumbing in the house.

The location of wyes in a sewer main, for future use, at the time it is constructed is a doubtful economy. Where wyes are placed in a sewer main for possible future use they should be accurately located, a record of such location made in duplicate, and the original and duplicate kept in separate places.

Seemingly, if asbestos-cement pipe is used in constructing the lateral sewer, cutting in wyes when and where needed later is a comparatively simple procedure, since this pipe cuts easily without fracture.

Conclusion

When a house connection sewer has been completed it is out of sight and soon forgotten by the owner. The only time it will be brought to his attention after he has finished paying for it, is when it gives trouble. In all probabilities the owner will soon forget its exact location. Even though the house connection sewer may be temporarily forgotten it is one of the important parts of a sewer system; but, too generally, this fact is overlooked.

THE BACTERIOLOGICAL BALL[1]

A gay bacillus, to gain her glory,
Once gave a ball in a laboratory.
The fete took place on a cover glass,
Where vulgar germs could not harass.
None but the cultured were invited,
For microbe chicks are well united.
They closely shut the ball-room doors
To all the germs containing spores.
The staphylococci first arrived,
To stand in groups, they all contrived.
The diplococci came in view,
A trifle late and two by two.
The streptococci took great pains
To seat themselves in graceful chains.
The pneumococci, stern and haughty,
Declared the gonococci naughty,
And said they would not come at all
If the gonos were at the ball.
Each germ enjoyed himself that night
Without fear of a phagocyte.
'Twas getting late and some were loaded,
When bang, a chlorine cylinder exploded!
And gassed the happy dancing mass
That swarmed the fated cover glass.
Not one survived, but perished all,
At that bacteriological ball.

—New Hampshire Health News

Crossing of the Susan.

In California rivers are frequently either dry gulches or raging torrents. So this is the method used in Susanville, Calif., of crossing the Susan River with water and sewer lines. Note the two suspension methods—cable suspension of the 8" sewer of light weight Armco corrugated pipe and strut stiffening of the W. I. water line. Both methods produced a safe and economical job.
(Photo by Courtesy Chicago Bridge & Iron Co.)

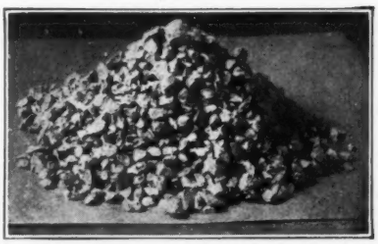
Rags, Rocks, Balls, Cannot Clog "Flush-Kleen"

"Flush-Kleens" eliminate pump clogging and costly maintenance labor which is required for dissembling and clearing ordinary sewage pumps.

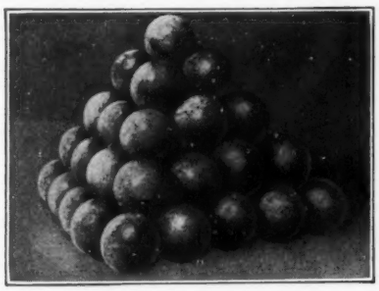
"Flush-Kleens" keep pump station in continuous service, eliminate shut-downs, prevent backing-up of sewers and flooding of pumping station.

HANDLED BY "FLUSH-KLEEN"

Twenty-two cotton towels 17"x29" discharged by "Flush-Kleen" in 5 minutes.



Pile of crushed rock, 2" screenings, discharged by "Flush-Kleen" in 82 seconds.



Fifty 3⅝" balls discharged by "Flush-Kleen" in 5 minutes.

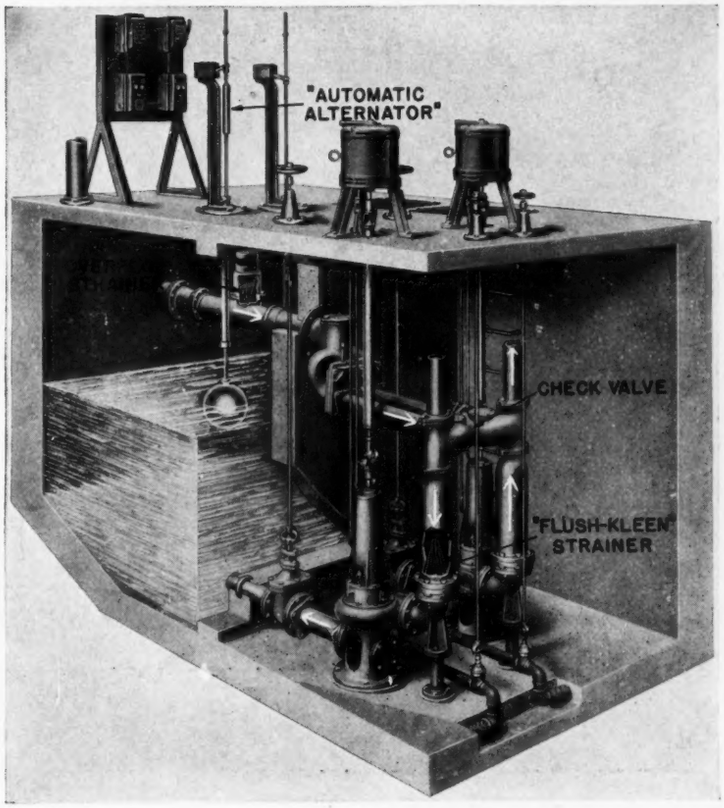


Fig. 2037—"Flush-Kleen" Sewage Pumping Station. While one pump is operating, sewage flows into the basin through the idle pump, as indicated by arrows. Coarse sewage matter is retained by the "Flush-Kleen" strainer in the idle pump—only water passes through impeller to wet basin. When the idle pump operates, the coarse sewage matter in the strainer chamber is flushed out through the discharge pipe with the water from the wet basin. The check valve prevents operating pump from discharging back through the inlet line. In the meantime, sewage flows into the wet basin through the idle pump. Automatic Alternator transfers operation from one pump to the other. Both pumps may operate during peak flow, at which time sewage inflow is through overflow strainer.

Material at Left Did Not Clog "Flush-Kleen"

during a Special Test on a small case 4" pump in 1927 by Engineers of Armour Institute. Reliability of "Flush-Kleen" has since been proved by over 2,500 installations in U. S. Army and Navy Bases, Municipal Sewage Stations, Ships and Buildings of all kinds.

Types of "Flush-Kleens" Available

DRY BASIN INSTALLATIONS: Underground in steel tank—in concrete or steel pit with motors on floor above. Pumps used—Vertical Pedestal Mounted; Vertical Open Shaft; Vertical Enclosed Shaft.

SUBMERGED INSTALLATIONS in steel wet well with Vertical Enclosed Shaft Pumps.

CHICAGO PUMP CO. SEWAGE EQUIPMENT DIVISION

2349 Wolfram Street, CHICAGO, ILL.
Phone BRUnswick 4110

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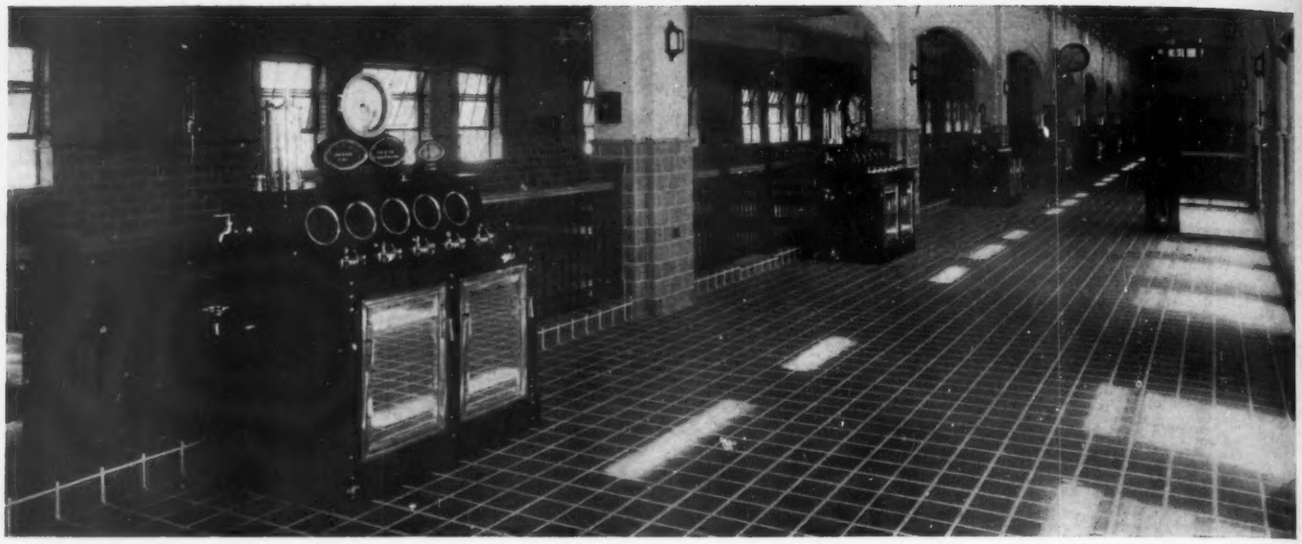
REPRESENTATIVES THROUGHOUT THE UNITED STATES AND FOREIGN COUNTRIES

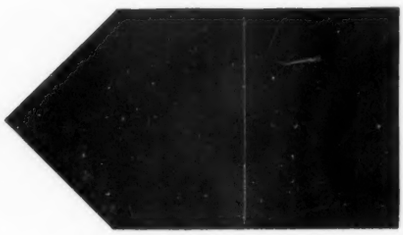
Ask for Bulletin 122



Operating Gallery—Bain Filter Plant
Raleigh, N. C.

W. C. Olsen, Cons. Eng.
Roberts Filter Co., Equipment Contractors

The SIMPLEX SAND EXPANSION INDICATOR



FILTRATION PLANT efficiencies must depend on the satisfactory control of all operating functions.

The use of sand expansion as a means for wash water control has long been accepted, but until the development of the Simplex sand expansion indicator, no device was available by means of which this expansion could be definitely measured, noted, and checked at any period during the wash cycle.

Over 300 units installed and operating in such recognized plants as those in Allentown, Raleigh, Greensboro, Sandusky and Toledo, have proved that by their use greater operating efficiencies have resulted because of increased filter runs, reduced costs, and elimination of troubles from mud balls and sand cracks.

The sand expansion indicator, low in price and simple in mechanical construction, fills the requirement.

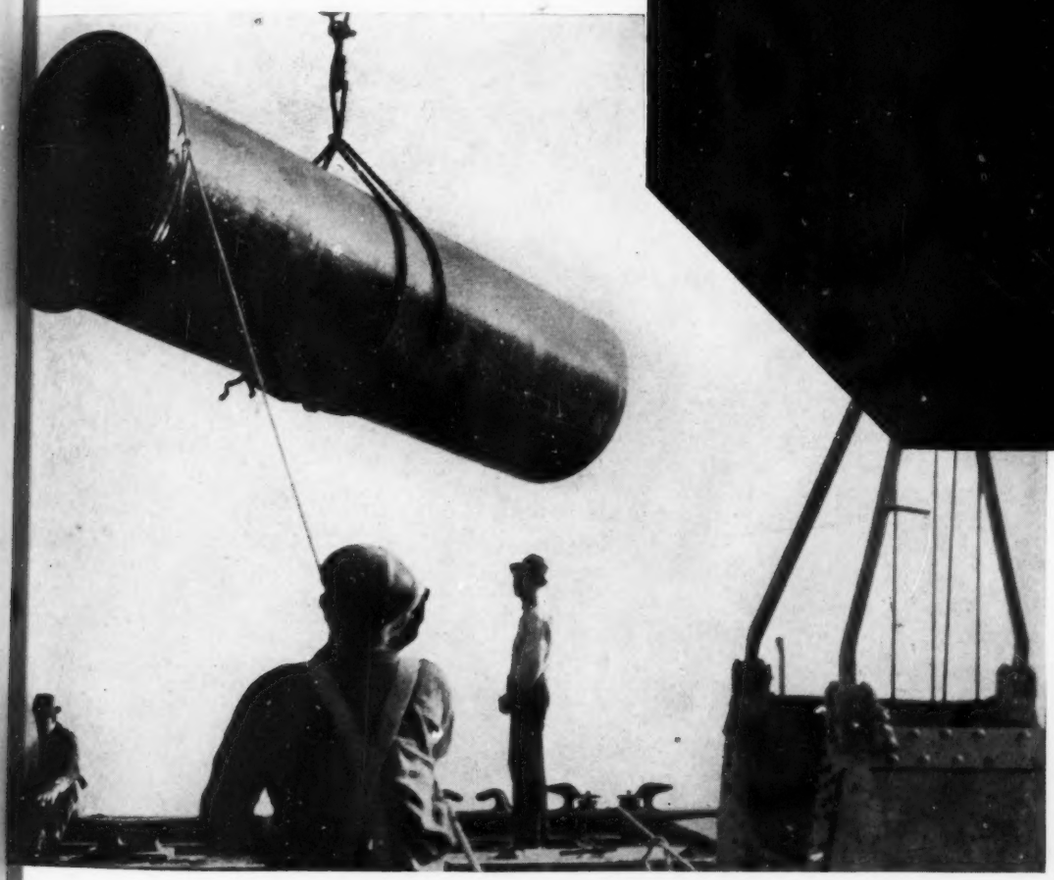
WRITE FOR BULLETIN 60

Let us show you how its use will eliminate your operating problems and reduce costs.

SIMPLEX VALVE & METER CO.
6743 UPLAND STREET • PHILADELPHIA, PA.

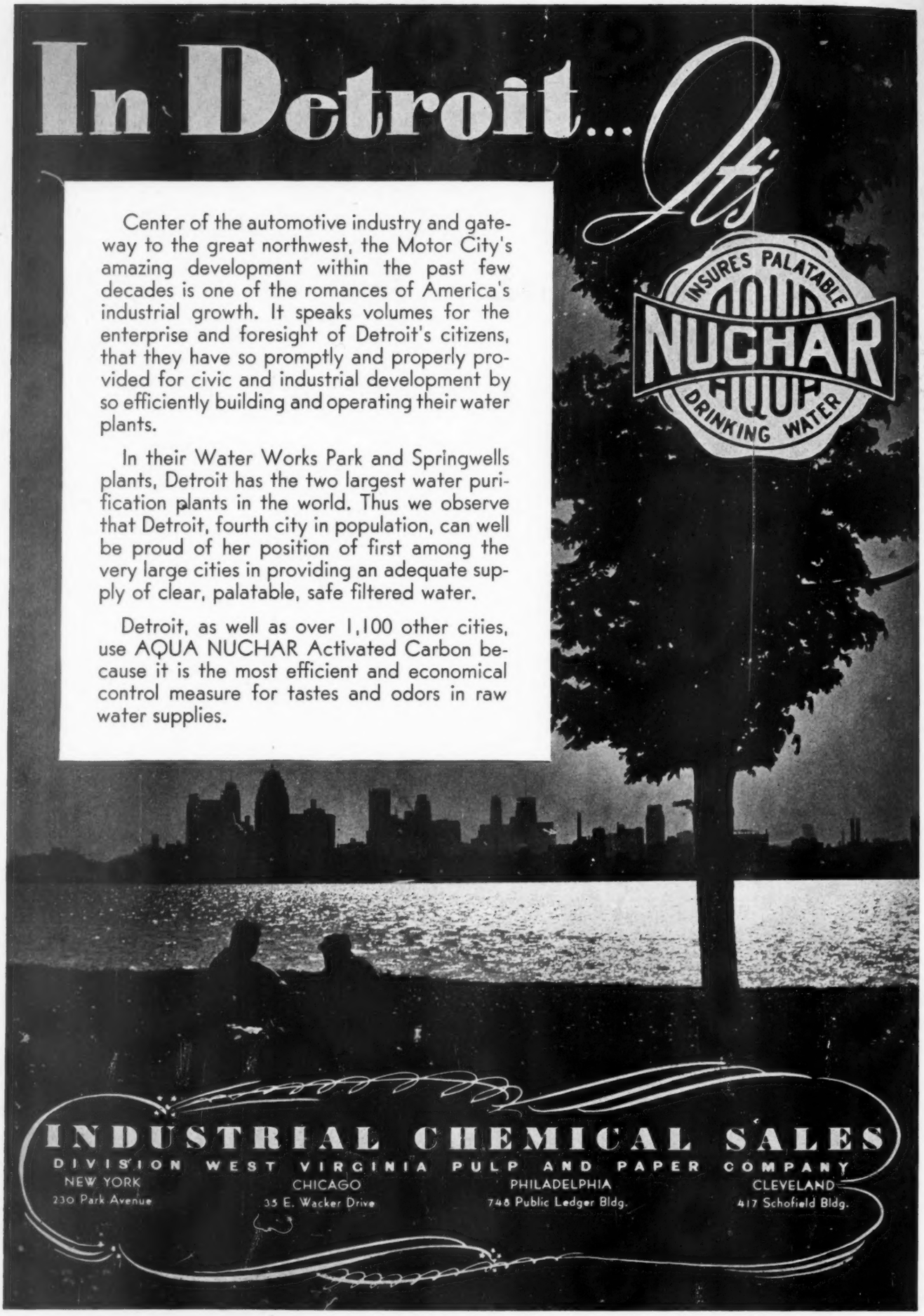
Cast iron pipe plays an important part in the vast program of sewage works construction. Here it is used in an air line of the treatment plant at San Antonio, Texas.

Look for the "Q-Check" registered trade mark. Cast iron pipe is made in diameters from 1¼ to 84 inches.



The trend to cast iron sewer mains is more marked each year. Photograph shows 36-inch cast iron pipe being installed by Central Delaware County (Pa.) Authority for an outfall sewer.

THE CAST IRON PIPE RESEARCH ASSOCIATION, THOMAS F. WOLFE, RESEARCH ENGINEER, 1015 PEOPLES GAS BUILDING, CHICAGO, ILLINOIS.


In Detroit... It's
INSURES PALATABLE
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DRINKING WATER
Center of the automotive industry and gateway to the great northwest, the Motor City's amazing development within the past few decades is one of the romances of America's industrial growth. It speaks volumes for the enterprise and foresight of Detroit's citizens, that they have so promptly and properly provided for civic and industrial development by so efficiently building and operating their water plants.
In their Water Works Park and Springwells plants, Detroit has the two largest water purification plants in the world. Thus we observe that Detroit, fourth city in population, can well be proud of her position of first among the very large cities in providing an adequate supply of clear, palatable, safe filtered water.
Detroit, as well as over 1,100 other cities, use AQUA NUCHAR Activated Carbon because it is the most efficient and economical control measure for tastes and odors in raw water supplies.
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THE SEWAGE DISPOSAL SYSTEM OF GOWANDA STATE HOSPITAL

By WILLIAM EDWARDS
Chief Operator
GOWANDA STATE HOSPITAL
GOWANDA, N. Y.

THE sewage disposal system of Gowanda State Hospital was designed by the New York State Department of Public Works, and constructed by the Walter S. Johnson Building Company, Inc., of Niagara Falls, N. Y., under a state contract supervised by the State Public Works Department.

The total contract cost of the project was $109,134.41, and included outfall and discharge sewers from and to the then existing main sewers; alterations to the then existing sewers; water, gas and electric lines; roadways, fencing and landscaping, as accessories to the treatment plant.

The plant was constructed on property owned by the hospital, which was particularly fitted for a sewage disposal plant because it was not suitably located for hospital buildings and because the topography was such that a disposal plant could be constructed there on the existing sewer gradient.

Plant Units and Functions

The method of treatment and units involved are briefly as follows:

(1)—*Chlorination:* The raw sewage is chlorinated at the point where it enters the plant by a continuous feed arrangement, manually adjusted.

(2)—*Coarse Screening:* Located in an open flume, the bar screen is equipped with an electrically operated and timed cleaner, and with an electrically controlled arrangement for continuous cleaning at high sewage flows. The screening equipment includes an electrically operated, manually controlled, grinder which returns the shredded screenings to the sewage flow.

(3) — *Primary Sedimentation:* Rectangular tanks serve as twin clarifiers in a building fully housed and fan ventilated. They are equipped with sludge and scum flight collectors, scum and liquid effluent troughs, lime feed lines, sludge pump suction lines and cat walks.

(4)—*Separate Sludge Digestion:* Is provided in twin circular concrete tanks, equipped with electrically operated and controlled stirring arms. The sludge is heated by circulating hot water through pipe coils on the interior walls of the digesters.

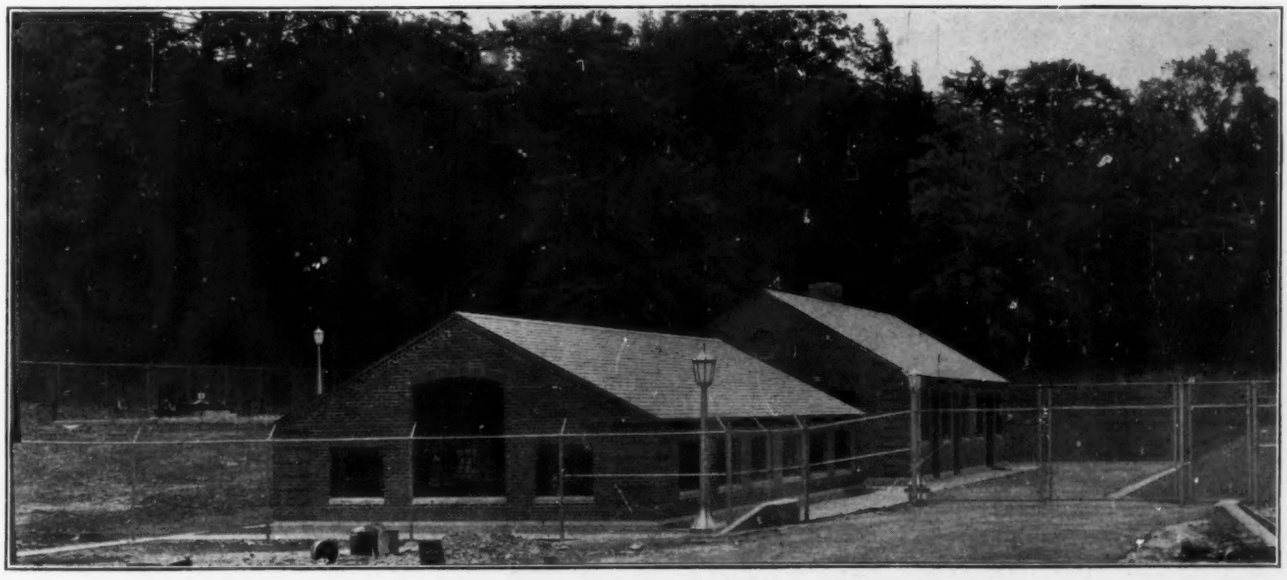
(5)—*Gas Collection:* The digester gas is piped through a meter and a flame trap to a boiler for heating the water which is circulated for heating the digesting sludge. A burner for disposing of excess gas is provided.

(6)—*Sludge Conditioning and Dewatering:* Sludge is pumped from the digesters to a hopper type storage tank, from which it is pumped at slow but variable speeds to the conditioning tank of the Oliver Vacuum Filter. In the mixing tank, lime emulsion and ferric chloride solution are added separately. The conditioned sludge is raised from the mixing tank to the drum trough by a bucket elevator. The filter drum in rotating in the trough picks up sludge and, under the suction created by the vacuum pump, water is drawn from the sludge. At one sector location of the rotating drum, the vacuum is broken by a port-valve and a slight pressure is furnished by a blower to break the dewatered sludge cake free from the drum. The cake is discharged into garbage cans and used for land fertilizer or mixed in a compost pile for nursery mulch.

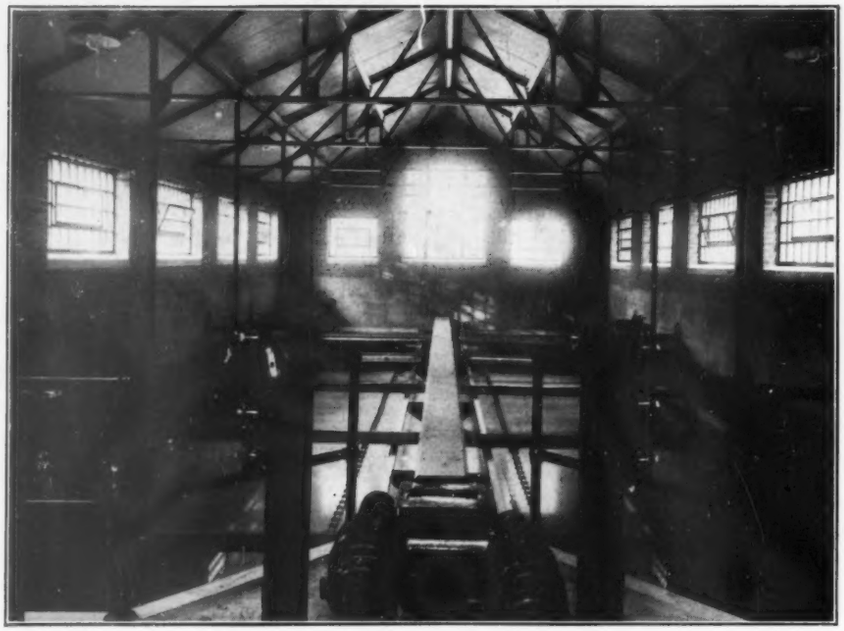
Effluent Disposal

The liquid effluent from the clarifiers (chlorinated) is discharged into Cattaraugus Creek through one mile of 20 inch sewer. This line has a total drop of 135 feet, of which 120 feet is through a series of drop manholes in a distance of 120 lineal feet.

The sewer system must be classified as a separate system, but the effect of a rainstorm is readily seen at the disposal plant by a decided increase in the sewage flow within 15 minutes of the start of a shower. It must also be considered that at such times the patients who are ordinarily working about the hospital are kept indoors or are brought indoors during periods of rains, and cause some increase in actual sewage flow.



The Sewage Treatment Plant of Gowanda State Hospital.
(Designed by the N. Y. State Dept. of Public Works—Henry Ryon, Chief Sanitary Engineer.)
Digesters on Left; Clarifier House in Foreground; Laboratory, Pump and Chlorinating House Beyond.



The Twin Clarifiers

The System in Brief

The following data is descriptive of the sewer system and furnishes a brief outline of the entire problem of sewage disposal at this institution:

There are 9 miles of sewers tributary to the plant.

There are approximately 150 manholes in the system.

There are 2 large grease traps near the kitchen buildings.

The patient population is approximately 2,400 adults.

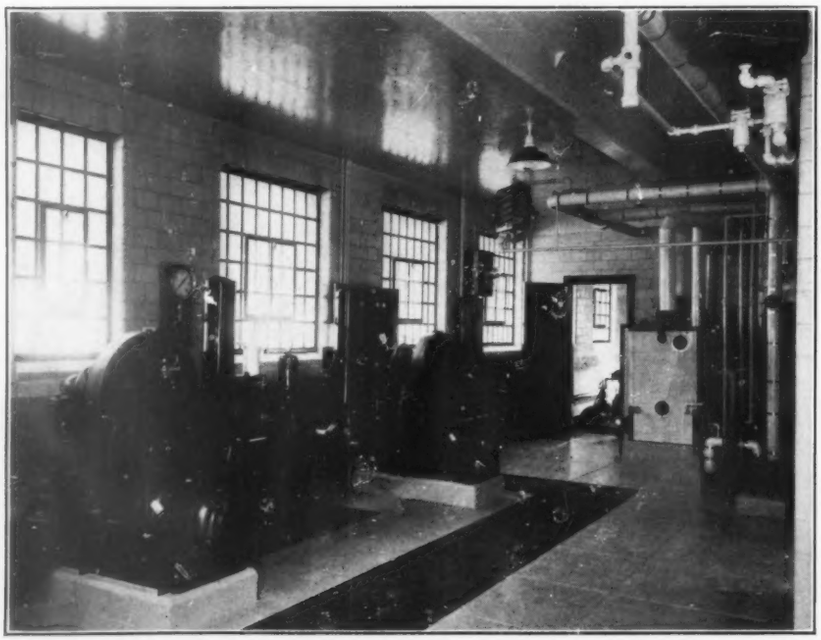
The resident employe population is 600 adults.

The part-time employe population is 100 adults.

The number of visitors may be considered as equivalent to 200 residents.

The hospital has a varied list of facilities which have a decided effect on the sewage treatment problem, such as large kitchens, a large laundry, industrial shops, a large pharmacy, a large bakery, a fully equipped cannery, a refrigeration plant, a butcher shop, sewing rooms and a mattress shop.

The water consumption averages 360,000 gallons per day.



The Pump Room

The sewage flow varies from 260,000 to 300,000 gallons per day as dry weather flow, depending on laundry schedules, etc.

The rate of flow varies greatly during the day. From a rate of 100,000 gallons per day during the period of midnight to 6 a. m., it increases to 300,000 gallons per day rate at 6:30 a. m.; to 400,000 gallons' rate at 9 a. m. and 500,000 gallons' rate at 10 a. m; to 200,000 gallons' rate at 9 p. m., and 100,000 gallons' rate at midnight.

The plant has only one operator, thereby requiring a routine type of operation. Sludge is pumped from the clarifiers to the digesters at about 8 a. m. and at 4 p. m. The chlorine feed (pre-chlorination) is adjusted to the sewerage flow during the day, but not during the evening or early morning.

The supernatant liquid from the digesters and the dewatering sludge filtrate are returned to the inlet end of the plant.

The two sedimentation tanks or clarifiers, and the two sludge digesters are used continuously in daily operation.

Each clarifier holds 34,000 gallons exclusive of the sludge hoppers. At a 500,000 gallon per day flow rate the period of retention is 3½ hours. At the more prevalent rate of 300,000 gallons per day the period of retention is 5½ hours.

There is insufficient data for determining the period of digestion required. Sludge has been removed from both digesters, but only on one occasion. Since the beginning of operation, the two digesters have been kept alike, as nearly as possible. After eight months' operation, 3,165 gallons of sludge were removed from each digester. Three thousand one hundred and sixty-five gallons of sludge produced 5,700 pounds of sludge cake, with a moisture content of 70 per cent, equivalent to 1,700 pounds of dry sludge.

Results

Test results show the following:

Water Supply pH = 7.8
Clarifier pH = 7.4
Digester pH = 7.2
Settleable Solids Sewage Influent, 6.0 c.c./liter.
Sewage Effluent, .1 c.c./liter
Temperature in Digesters, 85°
Average quantity gas produced, 2,600 cu. ft./day
Average quantity Chlorine used, 31 lbs./day
Average quantity of Lime used, 10 lbs./day

Quantity of Ferric Chloride used for sludge = 20 lbs./1,000 gal.

Quantity of Lime used for sludge = 50 lbs./1,000 gal.

Comments and Observations

Considerable trouble has been experienced with sticks, stones, nails, etc., which have been found in the clarifier sludge hoppers and in the pump valves. This in spite of the fact the plant had been broom cleaned an operated with clear water for a week before the sewage treatment started.

Hospital wastes, such as splint wood and tongue depressors, obstruct the sludge pump valves.

Rags and laundry lint which pass through the screen or are torn to strings by the grinder become matted at the sludge pump suction intakes in the clarifier sludge hoppers.

Fruit peels, match sticks, etc., are concentrated in the scum.

Water vapor in the clarifier building is not effectively removed by the suction fan and the long suction duct to the pump house. In this regard, it should be stated that a strong current through the building to the fan would increase the quantity of vapor until the air temperature and water temperature are more nearly equalized.

The sludge pumps have been kept well lubricated and no difficulty has been experienced with leakage.

There has been no difficulty of foaming, probably due to the long period of digestion, the continuous operation of the stirring mechanism, and due to recirculation of the sludge by pumping in the early period of operation.

Group Present at the Opening of the Plant

(Top row) Chief Engr. N. W. Andres, Who Has General Supervision of the Plant; Wm. Harmon and Clarence Snyder. (Lower row) Dr. E. V. Gray, Supt. of the Hospital; Wm. Edwards (the author), Chief Operator of the Plant; M. D. McDonald, Asst. Engr., Dept. Public Works; Earl Harrington, Constr. Engr.; Paul Kriegel, Filter Plant Operator; Robert Wells, Asst. Sewage Plant Operator; Henry Ryon, Chief Sanitary Engr., N. Y. State Dept. of Public Works; Paul Kriegel, Jr., Asst. Plant Operator; S. F. Wheater, Steward; Dana Gage and Henry Kelley, Electricians.

Odor control at this plant is principally by clorine feed. The feed should be adjusted to the sewage flow. A high chlorine residual during periods of low flow is of no value to a later higher flow. Consequently, the chlorine feed should be raised at about 6 a. m. and adjusted at various times during the day until 10 p. m. To accomplish this control, however, assistant operator would be needed.

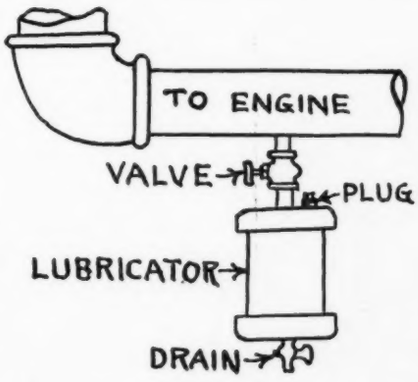
Acknowledgments

When our plant was put in operation there were no employes of the hospital familiar with its operation. Engineers of the Public Works Department, Messrs. Henry Ryon and M. D. McDonald furnished data and instruction. Visits were made to the Willard State Hospital where a somewhat similar installation is operated by R. J. Murphy, and here intensive course of instruction was received.

A Simple Home-Made Lubricator*

For emergency service you can make a surprisingly good lubricator out of ordinary pipe fittings—a lubricator that will actually "work." It won't "freeze" like some of the old lubricators that I have had experience with, and perhaps you have had similar experience.

The accompanying sketch shows plainly how to make this lubricator —out of two small nipples, one large nipple which I have marked "lubricator," a valve, a drain cock, two caps, and a plug. Suit yourself as regards sizes, except that a small valve is preferable. Put them together as shown, making everything steam tight, and your lubricator is complete.



Fill the lubricator with cylinder oil through the plug and then replace the plug. When the valve is opened condensate will be forced down beneath the oil because water is heavier than oil. The oil will, in consequence, be displaced by the condensate and flow out into the steam pipe and to the engine, pump, or whatever it is that you wish to lubricate. The rate of flow of the oil is readily adjusted by means of the valve.

The proper rate of feeding can be determined by occasionally slowly draining out the water until oil begins to show, observing the volume of water, and refilling with oil. Naturally the water volume represents the volume of oil fed, if the lubricator is filled absolutely full at each refill. After a while you will know just how much to open the valve for the desired feed, how often to refill with oil, etc. At first it will be necessary to do some experimenting to determine the best valve setting. Keep tab on where you open it during each experiment. You will soon hit on the right spot, which can be marked with a light chisel cut on the stem and gland nut.

*Contributed by W. F. Schaphorst, M.E., Newark, N. J.

THE WASTE CONTROL LABORATORY OF THE ATLANTIC REFINING CO.

By W. B. HART
Chemical and Sanitary Engineer
ATLANTIC REFINING COMPANY
PHILADELPHIA, PENNSYLVANIA

The problems of the petroleum industry are no small ones when it comes to treatment of the heterogeneous types of waste waters from oil well fields and processing works of this large and important industry. The question of oil waste treatment is of interest over a large area of the country and to a great many people. It is, therefore, one of the most important, as well as one of the most difficult, amongst waste treatment problems.

"Water Works and Sewerage" has been most fortunate in arranging through the author of this introductory article, telling of the development of thoroughly equipped and manned laboratories by one large petroleum refining company solely for the purpose of studying and developing analytical methods and processes of waste treatment, for a series of articles outlining the problems and setting forth methods evolved and equipment developed in providing treatment of petroleum wastes.

In forthcoming issues this series of articles will appear, as will others dealing with the treatment of wastes from a variety of industries. Feeling that industrial waste treatment now holds first rank position in the further curtailment of stream pollution, it is our intent to devote a fair amount of space in future issues to this important problem.—L. H. E.

"WHAT in thunder are they doing with fish food down at the refinery? Is that charge all right?"

The surprise expressed by the clerk in the cashier's office is understandable, for the relationship between gasoline motor oil, dried shrimp, ant eggs, etc., seems to be, to the uninformed, a most unusual one. But the fish food *is* related to gasoline and other petroleum products. Truly it is not a part of them; nor is it used in the manufacturing processes by which they are produced. These processes create wastes, however, and the wastes must be disposed of. In so doing harmful effects upon aquatic life are possible, for usually these wastes are either liquid or can become mixed with the large quantities of cooling water that the average petroleum refinery uses and discharges to an adjacent stream or other water body. And here the fish food has its place, for the fish it is fed to are used in turn in the experimental work conducted in the Waste Control Laboratory maintained at the Philadelphia Refinery for control of waste treatment processes operated by the Atlantic Refining Company on its various properties. Fish and other aquatic life are also used for research in waste disposal and development of waste disposal procedures.

But experimental work using fish is only one of many phases of the work conducted by the Waste Control Laboratory, which has now been in existence for eight years. It had its origin in connection with the hydraulic problems involved in separating oil from water during the development of an effective and economical separator.

Then came the necessity for determining the degree of success attained by the separator developed. For this purpose fish tanks were installed in which the effects of the

Two Views of the Chemical Laboratory for Experimental Work and Waste Disposal Control—Atlantic Refining Co.

Two More Sections of Atlantic Refining Co.'s Waste Disposal Control Laboratory at Philadelphia.

(Left) One-half of Section Devoted to Bacteriological and Microbiological Studies; (Right) Section Devoted to Studies Involving Larger Aquatic Forms and Fish, also Hydraulics. This Section Also Contains the Pilot Plant for Waste Treatment Studies.

corrected waste water could be investigated. Not only were the effects on the fish wanted, but also the criterion value of the fish reactions in estimating the possible effects of the wastes on those receiving waters which later serve as a source of domestic water supply.

The logical next step following this development was the design and construction of a laboratory scale water purification plant. This was given much study and before making any start on the actual equipment construction, water purification plants and their laboratories in many sections of the country were visited and the equipment design was discussed with water purification operators. The result was the final construction of a laboratory and facilities, so arranged as to flexibility that practically any purification procedure can be tested, improved or developed.

Use of the various equipment that has been developed naturally required a fairly well equipped chemical laboratory. Such a laboratory was also required to make the routine control tests of waste water disposed of by the refinery. At first this work was conducted by the general refinery laboratory. From a rather modest beginning in which the simpler analytical procedures could be carried out, a laboratory was built up that required no assistance from the main plant laboratory and all waste disposal control work was taken over.

Waste Control Work Grew

As the waste control work grew the public spirited and far-seeing policy of the company management was growing. As various waste treatment methods were developed and installed at the Philadelphia Refinery, other problems were brought to the laboratory for solution. These came in from all divisions of the company activity, requiring the full time of a technician devoted to the laboratory work under the direction of the superintendent of the department responsible for pollution prevention work. The real growth of the laboratory then began, for as each problem was presented it was completely investigated and discussed with those acquainted with problems of that nature. The necessary equipment for full investigation was obtained or designed and constructed. Since so much of the work was of a pioneering nature, apparatus and methods of analysis frequently had to be devised to meet conditions. These methods have been recorded and have been of great value.

The final development of the laboratory to the completeness of today is actually a record of the various problems it has handled. Its work is now conducted by a Registered Engineer trained and experienced in Public Health Engineering, Sanitary Engineering and Chemistry. The facilities available meet the needs for attacking any problem in the disposal of wastes from any type of industry, and also domestic sewage. The phases of its work include hydraulics; chemical, bacteriological and physical examinations; microbiology and biological investigations, and questions of corrosion connected with wastes. In conducting the work a well balanced library has been built up and references from a variety of publications include over ten thousand items.

And Now a Real Laboratory

It has been stated that the laboratory had a very modest beginning. It did, for its first location was a corner of the operation office in the refinery. This was soon outgrown, however, and one room on the ground floor of the building it now occupies became its home. But the growth in activity experienced during the past four years made this location only temporary. Today the laboratory occupies 1,500 square feet of floor space divided into four sections. One section is for the physical and chemical activity; another is for general microbiological and special bacteriological studies; a third is for the fish tanks and investigations involving larger life forms, hydraulic equipment and semi-works equipment. The fourth section, used for storage, contains a conference room which serves as a staff meeting place for the purpose of holding discussions.

Some of the work carried out by the laboratory has been published and it is the present plan that in the near future other studies will be reported in accord with the company policy of natural resource protection and as a contribution to that worthy cause.

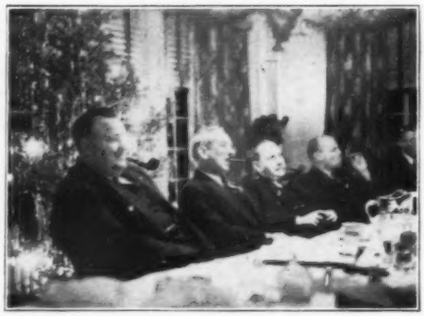
LONG ISLAND SECTION CELEBRATES 6TH YEAR OF SERVICE

WHAT is thought to represent the first Section of a State sewage works association was established to serve Long Island's sewage plant operators just 6 years ago, when a group of 24 operators and managers and at least one Sewer Commissioner met and decided to form a local Section of the New York State Sewage Works Association. From this handful of 24 charter members the Section has since grown to a membership of 165 at the six year mark.

The success of the Long Island Section has led to the establishment of three other regional Sections. Serving as member feeders to the parent association, these organizations bid fair to maintain the New York State Association in first position as the "World's Largest Sewage Works Association."

Boasting amongst its members several past presidents of the parent association and as many more who have won awards for meritorious papers and excellence of plant operation, the Long Island Section of N. Y. S. S. W. A., holding one of its quarterly meetings at the Hempstead (L. I.) Country Club on December 27th, heard its founder and continuing Secretary review an interesting history of six years of progress and service to Long Island sewage works operators, and, in turn, to their communities. By acclamation, Lawrence L. Luther, of Freeport, was re-elected for the sixth consecutive time to carry on the good work. Sitting on his left at the head table was Wellington ("Duke") Donaldson, who rightly takes some pride in being a co-founder with "Larry" Luther. And with both sat another charter member who is the present president of the parent association, George Anderson, Rockville Center's Superintendent of Sewerage. In the center sat the guest of honor, Mayor George M. Estabrook of Hempstead, who boasted the distinction of having served as engineer on the first treatment plant built by the city longer ago than he cared to remember. And on the Mayor's left, Charlie Agar, a past president of N. Y. S. S. W. A. and guest speaker.

Presiding as "Chairman of the Day" was Leslie Marshall, City Engineer of Hempstead, who introduced his boss, the Mayor, as possibly one of the worst sewerage engineers he had ever known or worked for. Then there was another boss present—Larry Luther's boss, Sewer Commissioner Frank Holland, of Freeport, who has come to be thought of as one of the boys when he attends meetings of the Section, and that is commendably frequent.



Head Tablers
(1) Secretary "Larry" Luther, Supt. Public Works, Freeport; (2) Leslie Marshall, City Engr. of Hempstead; (3) the Mayor of Hempstead, Geo. M. Estabrook; (4) Guest Speaker C. C. Agar, Sr. Sanitary Engr., N. Y. State Dept. of Health; (5) the President of the Parent Association, George Andersen, Rockville Center's Supt. of Sewerage Out of camera range was Wellington ("Duke") Donaldson of Lynbrook, co-founder and new director of the section, who is N. Y. City's Director of Sewage Disposal.

So if you would seek a pattern of a really successful and resultful organization of sewage works operators and managers, study "Luther's Long Islanders," where managers, commissioners, city engineers and mayors gather to make for harmony, a better appreciation for the work and problems of each, improved operator status, better equipped plants, and higher levels of operation and maintenance. Said Secretary Luther in his review of "Six Years of the Section," if asked to name the uppermost accomplishments in his mind, he would name those just enumerated. He hardly needed name more but added that the spirit of comraderie engendered between neighbor operators had resulted in a spirit of lending all possible asistance one to another in solving problems and improving plant performance. And not the least had been the pride built up in plant appearance and sightliness of grounds, resulting in increased interest of the press and the community in the local plants.

The Chairman
Leslie Marshall
City Engineer
Hempstead, L. I.

Honor Guest
George Estabrook
Mayor
Hempstead, L. I.

Customary Plant Inspections

According to custom, the meeting started in the afternoon with an inspection of nearby sewage plants—this time Geo. Andersen's disguised new Pumping Station at Rockville Center; the Treatment Plant of Mineola (Frank Hall, Supt.), and Hempstead's Treatment Works (Peter Kelly, Supt.).

The Dinner Session

As "Chairman of the Day," City Engineer Leslie Marshall of Hempstead presided at the Dinner Session. The Honor Guest was Hempstead's Mayor, Geo. M. Estabrook, an ex-sewerage engineer, who said that after he got through with Hempstead's first plant (and "headache") he quit the game. (However, they didn't run him out of Hemstead; made him Mayor instead.—Ed.)

The main technical speaker of the evening was C. C. Agar, Senior Engineer of the N. Y. State Dept. of Health, who spoke as one well versed in sewage plant operation and an ex-operator himself.

As usual Charlie Agar's talk was interesting. His subject was, "A Decade of Sewage Treatment Progress," in which he set forth the important advances of 10 years which he thought hardly could be equaled in the next decade. Then he enumerated present day trends in sewage treatment practices and, looking ahead, ventured some intereting predictions for practice in the future, which he based on indications and trends of today.

Mr. Agar pointed to the 1930-1940 increase in sewage treatment in New York State as more than equaling progress of the previous quarter century, leaving only 20 per cent of the State's population (N. Y. City excluded) now without sewage treatment, as compared with 65 per cent ten years ago. In commenting on improvements of the decade, he noted as outstanding the speeding up of processes and improved mechanical equipment, (1) the slow motion sep-

tic tank and Imhoff tank of "horse and buggy days," as compared to the controllable heated and mechanically stirred separate digesters; (2) the rebirth of chemical precipitation made possible by mechanical flocculation and sludge handling equipment, cheaper chemicals and more exact control methods; (3) the extended and varied uses of chlorine; (4) straining filters of fine grained materials, magnetite and sand; (5) the rejuvenation of the old reliable trickling filter through the high rate operation without odor and fly nuisances of the old slow trickling filter; (6) the flexibility of high rate filtration and adaptability to industrial sewages; (7) the speedy sludge dewatering by vacuum filters; (8) incineration of sludges and screenings vs. land dumps; (9) the growing recognition of the need for competent plant operation, resulting in adoption of operator certification or licensing in 16 states, with 12 more planning such.

Concerning progress with chlorination, and its variety of uses and adaptations in sewage treatment, Mr. Agar stated that over 80 per cent of the newer plants in New York State are equipped for chlorination and employ the process for one or another purpose or effect.

In looking at probable future trends, Mr. Agar stated that effluent straining in some form would be rather generally employed to produce more pleasing effluents, representing the principal appeal of the activated sludge process; practically every sewage plant effluent would be chlorinated in time; a more varied application of high rate bio-filtration for flexibility of treatment; the greater dependence on mechanical filtration (straining), permitting briefer settling periods (smaller plants); increased application of chemical treatment, for industrial wastes or for combination plants in particular; for operators, higher recognition and professional or civil service standing, and with it more commensurate salaries.

Veteran "Al" Johnstone and His Audience
To Which He Served-Up a Morsel of Philosophy and Wit to Finish Off the Speech-Making Course.

Officers and New By-Laws

At this point Mr. Luther made his accounting as "Steward of Six Years." He was thanked and was re-elected by acclamation. Wellington Donaldson was once more chosen a Director and presented a new set of by-laws, drawn up to improve the functioning of the Section.

"Al" Johnstone Reminisces

For the last was saved some morsels served up by Wallace and Tiernan's veteran, "Al" Johnstone, who has been selling chlorinating equipment in the sanitary field longer than most members of the Section can remember back.

"Al," with his handsome shock of silver billowing under a ceiling light and in his humorous fashion of mixing philosophy with dry wit, served up the speaking "dessert" of the evening in a closing talk. In analyzing the very narrow margin between what he defined as the high plane of exhilaration and that stage which police have a way of defining as intoxication, he cited the difficulty of determining the exact "end-point" or the "change-over point" or the "break-point," perhaps, between these two merging and disturbingly overlapping conditions. He cited the weakness of the "Donaldson Index" in determining the "exhilaration end-point" and the onset of intoxication vs. the indisputable proof and dependable results from the "Johnstone Method."

This took him into a discussion of the officer of the law and the mother-in-law factors involved in the two equations. And from exhilaration, inebriation and intoxication, "Al" slid over into chlorination and some reminiscences of an earlier day. Then in still more serious vein came his recollections from "Six Years on the Sidelines of the Long Island Section," and the progress made in Long Island plant operation during this period.

It was then 9:45 p. m. and the meeting was adjourned. Some went home to see Mrs. Santa Claus, while the "Bar-barians" lingered.

"Bar-barians"
(1) On left in this group is Northport's Supt.—Joe Ketcham, and "friends" (2) Herbert Johnson, Supt. of Great Neck's Belgrave District, and Clarence MacCallum, Cons. Engr., Port Washington; (3) "Bill" Highberger of Mathieson Alkali (the cigars were on him), and Rodney Cook, Suffolk County's Sanitary Engineer.

At Mineola's Activated Sludge Plant
(1) The plant, where (2) Mineola's Mayor Joseph Nohowek joined the group, which became rather intrigued with (3) the flock of ducks maintained on Mineola's effluent percolation beds. Facing the camera in the center of group is Frank Hall, Mineola's Supt. of Sewerage, and "Director of Ducking."

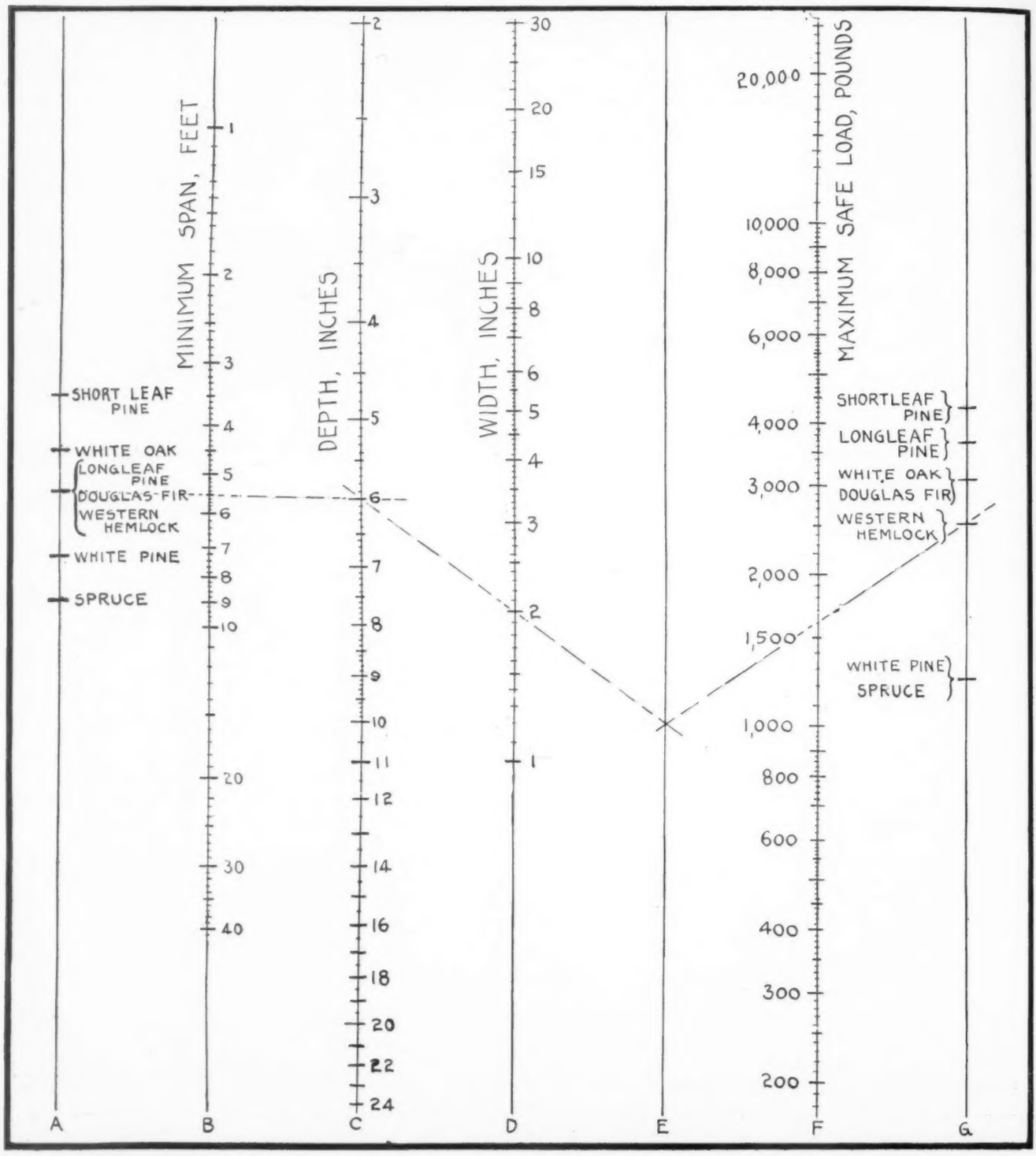
The Safe Strength of Wooden Beams Quickly Revealed by Accompanying Chart

By W. F. SCHAPHORST, M.E.
NEWARK, N. J.

THE writer has been complimented regarding the I-Beam Chart which appeared on page 501 of the October issue of "Water Works & Sewerage," and he has been asked whether or not he has a chart pertaining to wooden beams.

The answer is "Yes." The accompanying chart will be found handy for many purposes—in the selection of safe beams made of ordinary woods such as shortleaf white pine, white oak, longleaf pine, Douglas fir, western hemlock, white pine, and spruce. The chart is based on data adopted by the American Railway Engineering Association for safe uniformly loaded wooden beams of rectangular section.

To use the chart, zigzag a straightedge across three times, or stretch a



thread across three times, as indicated by the zigzag dotted line, and the problem is solved.

For example, it is desired to hold 200 lb. per foot on a wooden beam of 2 in. by 6 in. western hemlock over a span of 5 ft. Will the beam be safe?

Run a straight line from the point in column A opposite "western hemlock" over to the depth 6 in column C. The intersection with column B shows the minimum span to be 5.5 ft. The beam will therefore be safe as regards span.

Then from the depth 6 in column C run a straight line through the width 2 in column D and locate the intersection in column F. Then from that point of intersection run a straight line over to the point in column G opposite "western hemlock." The answer is found at the intersection with column F and is 1600 pounds.

Since it is desired to hold only 5 x 200 or 1000 lb. on the 5 ft. beam, and since the beam will actually hold 1600 lb., it certainly is amply safe. In fact, the chart shows that a beam made of white pine or spruce would be safe under this load.

Inversely, the chart may be used for finding any unknown factor or factors. If the kind of wood and the span are known, the first straight line through columns A, B and C gives the minimum depth of beam which must be used. If the width of beam is unknown, the line through the columns E, F, G is located next, and lastly the line through columns C, D, E gives the minimum width of beam in column D.

The weight of the beam itself is included in the safe load given in column F, hence the user of the chart need not worry about that factor.

"EXPEDIENCY"

(Author of Those Expedient* Dear Bill Letters)

"Doc" Taylor

From D. R. TAYLOR
Plant Superintendent
ROANOKE, VIRGINIA

Dear Bill:

The taxi driver said that what he liked most about his work were the people he "ran into." I presume that it is that "something different every day" that makes the average water works superintendent so interested and engrossed in his vocation and day-to-day work.

I am not at all surprised at your expression of gratification with the use of copper tubing for service pipe. I suppose that you are saving all of your 1½ inch and 2 inch galvanized pipe that you salvage during the renewal of such lines. If not you should because I will tell you that we find that this reclaimed pipe comes in mighty handy wherever soil conditions are conducive or pavement and grass plots suggest the jacking or driving through of a service, to preclude the expense and damage accompanying trenching.

In the installation of copper services it is often a simple job to drive a piece of this old salvaged pipe under a concrete pavement or a nice grass plot and to push the copper service pipe through the driven pipe, resulting in a material saving to the department, credit to the workmen, and often a word of commendation and appreciation from the consumer.

Here in Roanoke we had a case once in which a copper service was installed perpendicular to and under the rails of a street car track, at which point we were continuously annoyed with electrolysis. We were successful in mitigating, if not entirely curing this trouble by renewing this copper service and re-installing it through a piece of salvaged galvanized pipe and grounding the galvanized pipe to an underground return to the power station.

Your reference to meter change gears reminded me of a trick that our meter service man uses that may be of interest to you. In making investigations on the consumers' premists for abnormal consumption we require the service man to note on his work order, if a leak is found, whether or not the meter is registering. If it is registering at a rate high enough that he can immediately discern the hand moving well and good, but if the meter is apparently not registering or is registering so slowly that it is difficult to tell whether it is moving or not, he removes the register box cover and places a match stem on the intermediate change gear and lays a pencil across the top of the meter casing immediately above and parallel with the match stem. The intermediate change gear of course moves so much faster than the test hand on the register that it is very easy for him to determine in a relatively short time whether or not the disc is moving, even though it is barely creeping.

Well, Bill, with fire hydrant inspections and the usual extra duties associated with the approach of winter, we are pretty busy; therefore I presume that I had better "hit the hay" and generate a little energy for tomorrow's jobs.

Sincerely,

"TOM."

[*Expediency in the dictionary is defined "suitability under the circumstance" or "that which promotes an end." Expedient is defined amongst other things as "profitable or useful."—Ed.]

British Act Regulates Sewer Use for Disposal of Trade Wastes

Under the terms of England's Public Health Act, a manufacturer has the right to discharge any industrial waste into a public sewer subject, however, to the ruling of the *local authority* which may, if it chooses, impose certain conditions or even refuse consent. In the latter event, the manufacturer may appeal to the Minister of Health.

Among the conditions which the local authority may impose are the following:

1. Fix the period or periods during which wastes may be discharged.

2. Require the elimination of constituents which would injure or obstruct the sewer or add considerably to the difficulty or cost of disposal.

3. Fix a maximum amount per day and rate at which the waste may be discharged.

4. Regulate temperature and require that the waste be neither acid nor alkaline.

5. Charge against the industry the cost of treating the waste based on both volume and composition.

6. Require the manufacturers to provide and maintain inspection chambers for sampling and metering the discharge.

From A.P.W.A.'s *"News Letter."*

SUPERCHLORINATION EFFECTIVELY ELIMINATES IRON BACTERIA

Scheme Involved Simple Feeding of Hypochlorite to Bottom of Drilled Well

By E. B. CARROLL
Sanitarian
PRESTON COUNTY HEALTH DEPARTMENT
KINGWOOD, WEST VA.

FOR more than one year the small community of Arthurdale, West Virginia, has employed superchlorination for treatment of its water supply. The successful results demonstrate that this method of treatment need not be limited to large plants. Exceedingly minor changes were found necessary to produce a vast improvement in the quality of water reaching consumers' services.

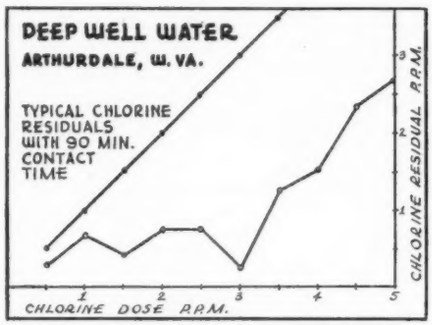
Our experiences at Arthurdale have provided an answer to several questions: (1) Can hypochlorites be used as the source of chlorine for superchlorination? (2) Can contamination due principally to iron bacteria originating in wells and first flourishing and then dying in watermains be eliminated by this simple means? (3) Will dechlorination be required?

Arthurdale is a Federal educational project which includes five school buildings, an inn, the Community Center, and twenty homes. Three wells supply an average water consumption of 14,000 gallons per day. Two shallow wells were intended for an emergency supply, but have been used almost constantly. From these water is pumped directly into the line feeding the school buildings, and a covered 50,000 gallon concrete reservoir floats on the system.

Deep Well Problems

Water from the deep well, on the other hand, is pumped directly to the same reservoir, thereafter feeding by gravity to the inn, Community center, and homes. The only treatment provided is hypochlorination of the deep well water with a Wallace and Tiernan "Chloro-Clock" which is a positive solution feeder of the displacement type. The displacement cylinder is lowered into the solution column by a clock mechanism at whatever constant rate may be desired. The hypochlorite solution is discharged through an over-flow tube to the point of application.

During 1938 a disagreeable musty odor became apparent in that part of the distribution system supplied by water from the deep well. This condition increased until a strong taste and odor, similar to decayed vegetation, was continuously present. When dead ends of the mains were flushed the familiar black water was discharged. Analysis of the water was made by the laboratory of the Public Health Training Center and indicated growth of the iron bacteria crenothrix to be responsible. The black-water was created by oxygen depletion and sulphate breakdown to form iron sulphide. Crenothrix is one of the filamentous iron bacteria, which grow in characteristic brownish masses or flocs.



The Break-Point Curve Obtained from Numerous Tests on the Deep Well Water.

The Hypochlorite Feeder Located in the Well Pit.

This feeder, seen to the right of the well pump discharge line, drips hypochlorite solution through the little white tube into the water seal and dilution pot. From this pot the diluted solution flows into the drop line to the well bottom.

Examination of the reservoir disclosed a half-inch thick deposit of this growth on the walls, and a layer completely covering the water surface.

In the early spring of 1939 the reservoir was drained and the concrete walls and bottom were scrubbed with a hypochlorite-copper sulfate solution. The deep well was also treated at intervals with copper sulfate. After each application of chemicals, large amounts of black sludge were pumped to waste from the well.

Chloramines Tried

When this treatment was completed, ammonia was applied in addition to chlorine. However, with a chloramine residual as high as 2.0 p.p.m. leaving the pump, it was never possible to obtain more than a trace of residual in the distribution system. This treatment was of considerable benefit, reducing taste and odor until they were noticeable only in the hot water. The disagreeable musty taste and odor reappeared at only two periods during the summer. This method of treatment, however, still left much to be desired.

In October, 1939, the Chlorine Institute's laboratory method for determining the superchlorination dosage of water came to the writer's attention. Tests were then carried out with water from the deep well. It was found that, in a 90 minute contact period, a hypochlorite dose of 3.0 p.p.m. satisfied the maximum chlorine demand of this water. The accompanying graph shows the typical residual breakpoint curve for this water.

Superchlorination Tried

Based on the laboratory tests, superchlorination with hypochlorite solution was started in November, 1939. At first a chlorine dose of 9.0 p.p.m. was applied to the well discharge line, and ammonia was added at the reservoir influent. The hypochlorite thus had about 75 minutes contact time before reaching the point of ammonia addition. Under these conditions, a residual chloramine content of 2.0 p.p.m. quickly

spread through the distribution system. No musty odor remained with this treatment, but a pronounced odor of chlorine excess was noticeable.

Since the laboratory tests indicated that 4.0 p.p.m. of chlorine should be adequate, the dosage was reduced to this point. Since this was done, no difficulty has been experienced. The hypochlorite solution is now applied through a drop line to the bottom of the well, and ammoniation is no longer required. Decrease of residual with contact time is shown in the following tabulation:

	p.p.m.
Chlorine dose applied	4.0
Chlorine residuals:	
Well Discharge	2.0
Reservoir Influent	1.0
Arthurdale Inn	0.03
Community Center	0.05
End of System	0.01

(The accuracy of the low residuals is questionable because of the presence of iron.)

Dechlorination Not Needed

With the contact time available, no dechlorination has been necessary, and growth of iron bacteria has been completely controlled. The simplicity and effectiveness of this simple treatment should recommend it to other small water supplies where similar difficulties are encountered. It has solved our taste and disinfection problem more easily than any other method tried. It was something of a surprise to us that dechlorination, planned for at the reservoir outlet, was not needed.

"PRECHLORINATION PLUS" GETS ANOTHER "PLUS" IN 1940

They Drink 4 ppm. Chlorine—and Like It

Dear Jim:

Received your letter the other day and am glad to hear that you are all well. The Mrs. saw your better half at the P. T. A. county meeting, but all the news I heard was strictly feminine, so was glad to hear from you.

Am surprised to hear that those new filters you started up last spring are showing mud balls; that is, surprised that it came so soon; guess that the small amount of iron you have helps stick the sand grains together. You know I am just dumb enough to fail to see how you can keep a sand bed clean by squirting jets of water up through it. Scout around and look over some of those old "air wash" plants or better yet those old round tubs with revolving rakes and find out how much mud formations bother them.

Got mixed up in some court proceedings at the county seat week before last and between sessions spent some time with Pete at his river plant. You remember I wrote you over a year ago about his heavy raw water pre-chlorine feeds and I wanted to see if he was still at it.

You know I have been at this game for quite a while and if I were to dig through my files I could find a good many cases where some bright boy has almost revolutionized the industry and suggested that our troubles would be fond memories if we followed his methods. Too often you can find nothing more about it in print, but a little inquiry will show that everything didn't continue to click and that he is back to first principles. Understand that I am not knocking new ideas, for if we did not keep trying to improve we would be a dumb lot indeed. It's

"Bob"

the cure-all like the old patent medicine "good for man or beast" that gets in my hair. But, let's get back to Pete and his "pre-chlorination plus."

4 P.P.M. Residual And They Like It

You remember that in August, 1939, he got up to over 10½ P.P.M. feed. Well, this year he reached 14¼ P.P.M. without having to dechlorinate, with an excess as high as 4 P.P.M. going to the system, and I mean just that, Jim, for his plant is on a city lot with consumers right next door, and here is a believe-it-or-not story. Some of the State Health men were around taking samples under the above conditions and a lady customer said, "The water is so much better since they do not put in so much of that chlorine." Now, that's one for the book, I think.

You may also remember that Pete was in a lather wondering where that heavy excess of 4 parts went, as hardly a trace was left two hours away from the plant. Well, I guess the answer is that Pete was one of the midwives at the birth of "break-point" chlorination, only the child had not been christened yet. After Griffin of W. & T. came out with his opus (a $10.00 word, Jim), Pete had a lot of work done on "break-point." After one sample showed break points at feeds of approximately 9½, 17, 24 and 36 P.P.M. he gave up and continued with his old methods of feeding all the chlorine the traffic would bear and give a satisfactory effluent, which after all is what we are all after. However, he is still wondering what would happen if he could operate on the break-point method of control. He has only about 2 hours of basin detention and the break point took about 30 hours with the larger doses. He showed me some time curves and it was most remarkable how the excess curve flattened out between the 16 and 24 hour contact points, and then abruptly fell during the next six hours.

Pete has another hen a-settin' now. His Board had him install one of those electric "cathode protection" outfits on a steel standpipe. The cost was only about half that of a paint job, which has proven to be no good, so he figured he had nothing to lose. The outfit was installed in mid-summer and no inspection has been made, as yet, but something is going on as several small leaks have started up. Pete doesn't like the looks of the rust stains on his aluminum paint but is willing to wait a reasonable time before making any wild statements.

Well, come down when you can, the latch string is always out.

Yours,

"Bob."*

*No less than R. G. Yaxley, Supt. Water, Waterford, N. Y.

[And "Bob" is "Pete" and "Pete" is "Bob." The first story of "Pete's" successful "Pre-Chlorination Plus" venture at Waterford appeared in our September, 1939, issue.—Ed.]

N. E. W. W. A.'S DECEMBER MEETING

Reported by DON CALDERWOOD
NASHUA, N. H.

WITH a luncheon attendance record of better than 200, the December meeting of the New England Water Works Association on December 19th was one of the best attended of the year.

In the forenoon, Professor George E. Russell, of the M.I.T., gave another of his lucid and interesting series of lectures on "Water Works Hydraulics," before the so-called Water Works School which precedes the Superintendents' and Chemists' Round Tables at each Winter Meeting.

Roger G. Oakman
Supt. of Water
Needham, Mass.
(Round Table Chairman)

Prof. Geo. E. Russell
M.I.T.
Cambridge, Mass.
(Water School Lecturer)

Professor Russell continued the previous lecture on flow of water through pipes, explaining the difference between streamlined flow and turbulent flow. He also included the reasons for and the theory behind the increased loss of head when water flows through pipe fittings, venturi, and disc meters, showing how this loss was usually expressed by an equivalent loss through so many feet of straight pipe of the same diameter.

At the end of the lecture Prof. Russell asked for suggestions of preferred subject matter for future lectures. If anyone has a special problem or subject of general interest that they would like to have discussed please send it to the association office in the Statler building, Boston.

Sup'ts'. Round Table

Roger G. Oakman, Needham, Mass., Chairman.

Topic: "Water Department Organization for Handling Emergency, Night, Sunday and Holiday Calls."

Mr. Oakman started the discussion by explaining the set-up of his department in Needham and told how emergency service was handled.

The most general method employed seems to be to have the foreman and older employes alternate in covering periods when the office is not open. This is accomplished in several ways, depending on local conditions, the more usual being a telephone in the employes' house interconnected with the regular water works phone, and special listing in the telephone directory. In many cases these men are on salary and receive no extra pay for this emergency service, but are furnished a telephone without charge. In cases where the men are paid on an hourly basis the usual procedure is to pay them time and a half for this extra service. Some communities provide living quarters over or adjacent to the office or yard, where the employes who handle these emergency calls live. In a few of the larger cities someone remains on duty during the entire 24 hours.

Paul Howard reported that in Winthrop they have a high and low pressure alarm connected to signal lights located in the police station. In several communities they have made arrangements with the police department to report trouble and notify the proper water works authorities by using their short wave radio and cruising cars.

Michael Quirk (Peabody, Mass.) suggested that the association do something to acquaint the public with the service rendered by these emergency men and in fact all water works employes.

The main idea behind this thought is that the labor in the water departments should not be classed with, and receive the same pay as, the man sweeping the street.

The discussion on winter maintenance problems was confined to the inspection, care, marking, and shoveling out of hydrants.

Others taking part in the discussion were:

William P. Melley, Milton, Mass.
Arthur C. King, Taunton, Mass.
Henry T. Gidley, Fairhaven, Mass.
William Duffey, North Andover, Mass.
S. S. Anthony, Augusta, Maine.
Allen McAlary, Rockland, Maine.
Fred J. Reney, Portland, Maine.
Horace J. Cook, Auburn, Maine.
Wm. A. MacKenzie, Wallingford, Conn.

*Chemists' Round Table**

Fred E. Smith, Cambridge, Mass., Chairman.

In the Chemists' Round Table A. E. Griffin, Wallace & Tiernan Co., put the cart before the horse and described "Breakpoint Chlorination." This was necessary because he had a paper on the subject in the afternoon meeting. Curves were shown depicting the relation between ammonia and chlorine in affecting the resulting residual chlorine. These showed the disappearance of the initial "hump" when the chlorine was sufficient to destroy the added ammonia. He called attention to the fact that both the ammonia and chlorine disappeared and then returned. Where they went he did not know, nor why they came back on the addition of more chlorine.

Fred E. Smith
Chemist
Cambridge, Mass.
(Round Table Chairman)

A. E. Griffin
Wallace & Tiernan Co.
Newark, N. J.
(Had a Full Day)

The effect of the pH on the reaction was brought out. The best pH was between 6.5 and 8.5, these being values *after* the reactions were complete and not before.

He told how the reaction with orthotoludine indicated when the break-point had been reached. An immediate flash to nearly full color indicating that the "break point" had been reached or exceeded.

It was brought out that to the right of the break-point "hump," as

*The Chemists' Round Table was reported by Marshall Wellington, Chemist, New Haven Water Co., New Haven, Conn.

it is called, nutrient froth tubes appeared as clear as when they came from the autoclave, while in the "hump" area they were cloudy and might have scum on them.

The ratio to bring about the break-point varied from one to ten chlorines to one ammonia, and at times the ratio might reach one to thirty. This ratio depended somewhat on the initial chlorine demand of the water. Albuminoid ammonia affected the curve in that the more there was present the less dip after the "hump" and at times the dip might disappear.

The average time for the reaction to take place was half an hour. Places were named where this method is used with success. As there are places where it is not applicable it was recommended that laboratory tests be run first to see if the results on the given water would warrant using it. It was called to the attention of those present that in the New England waters ammonia would have to be added to about 0.25 p.p.m. to induce a "break-point."

The discussion centered around the economics of the method.

Afternoon Session

President Leland G. Carlton, Springfield, Mass., presiding.

The following papers constituted the afternoon program:

"Selective Service in the National Defense Program" by Major D. B. Weden, Public Relations Officer, Mass. State Headquarters for Selective Service, Boston.

Maj. Weden outlined and traced the history of selective service from the bible times up to and including the workings of the 1940 registration and draft. He stated that the 1940 draft is based on the satisfactory experiences of the 1917 draft, the major difference being that there were no blanket exemptions or deferments in the 1940 law.

"Some Chemical Aspects of 'Break-Point' Chlorination" by A. E. Griffin, Ass'n Director, Technical Service, Wallace & Tiernan Co., Newark, N. J.

Mr. Griffin showed slides and explained how break-point chlorination worked with the various types of waters. Two of the major factors upon which this break-point depend are the amount of ammonia in the water and the pH value. Therefore it is naturally much more marked in waters taken from polluted streams than from upland streams, ponds, and ground water which form the major source of supply for most of New England. At the conclusion of his talk he outlined how anyone could perform a series of tests to obtain the break-point of his own supply without the use of complicated or expensive laboratory equipment. (Also see Mr. Griffin's discussion in the Chemists' Round Table session.)

"Manufacture and Laying of Large Precast Steel Cylinder Reinforced Concrete Pipe for the New Pressure Aqueduct of the Metropolitan Water District" by Stanley M. Dore, Ass'n Chief Engineer, Metropolitan Water Supply Commission, Boston.

Mr. Dore showed slides, colored movies, and explained the construction of this new aqueduct. It was an excellent opportunity for those who did not have a chance to see the actual work in progress to observe how a really big job was successfully handled.

Sabotage Committee

President Carleton announced the appointment of a Special Committee on Sabotage with the following members:

*F. H. Kingsbury, Mass. Dept. of Health.

Howard H. Potter, Maine Public Util. Com.

F. O. A. Almquist, Jr., Conn. State Dept. of Health.

Chas. D Howard, N. H. State Board of Health.

Walton Shea, R. I. State Board of Health.

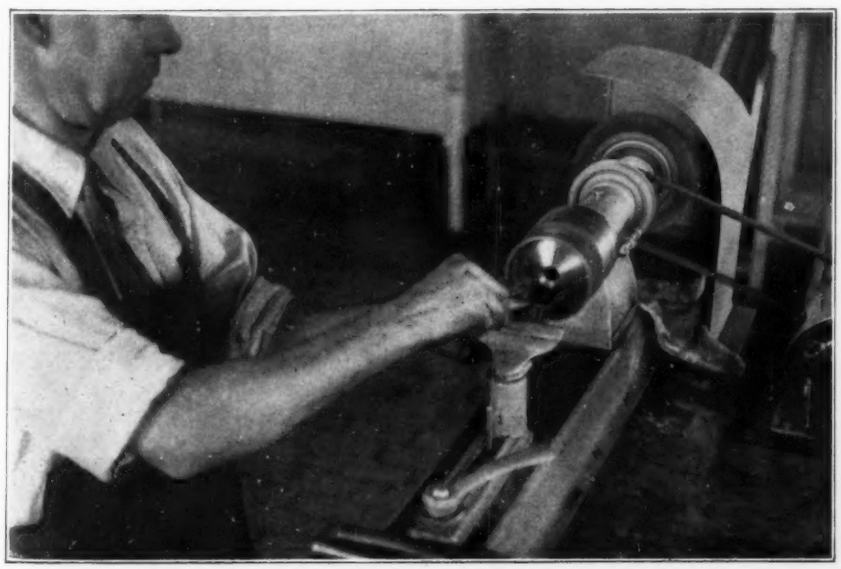
C. P. Moat, Vt. State Board of Health.

*Chairman.

A METER CLEANING KINK Developed in Akron's Meter Shop

At Akron, Ohio, they have occasion to clean up many meters in which the disc chambers are rather badly corroded inside. They have found the best way to do this is to fasten the disc chamber in a small lathe and then use a flexible steel wire brush, holding it against the chamber as the latter revolves.

This operation takes but a few seconds, cleans the chamber nicely, and they say that only the corrosion and none of the metal is removed. After this operation they brush onto the cleaned surface a mixture of paraffin oil and graphite. This makes the disc operate very nicely although of course the oil and graphite are washed out sooner or later in service.



Brief items, such as this one is, submitted "for whatever value it might have to the readers of *Water Works and Sewerage*," are most welcome and desirable.

If every reader will consider this an invitation to participate in an "exchange of ideas" for publication in future issues, and will do his bit in this direction, quite a valuable "Kink Book" can be produced by clipping the worthy contributions of this nature.

Mr. Reader, if you will keep this in mind, something very worth while can result through your cooperation and participation in this "exchange of ideas."—L.H.E.

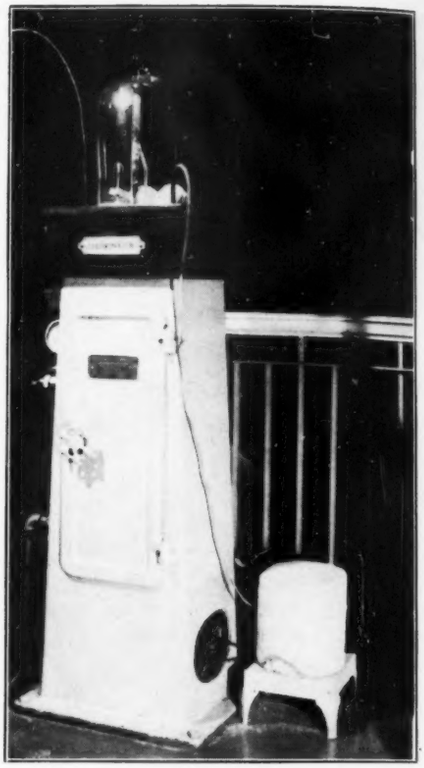
SIMPLE DE-ICER FOR CHLORINATORS

By E. E. WOLFE
Superintendent of Filtration
HANNIBAL, MO.

CHLORINE hydrate, or "chlorine ice" as it is more popularly known, makes itself troublesome when the water flowing through the chlorinator falls to a Fahrenheit temperature in the lower forties. This trouble is manifest in two ways. First, the "ice" builds up progressively around the glass metering tube to such an extent that the calibrations on the tube are entirely obliterated. Second, the "ice" forms somewhat more slowly around the hard rubber ball floats to the point where these balls are weighted and even cemented together, thereby interfering with the accuracy of the chlorine feed and reducing the automatic safety features for which these floats are designed.

Earlier methods of reducing chlorine hydrate formation involved the application of radiant heat above the bell jar. Sometimes an electric heating coil was used, but more often the heat from electric light bulbs was depended upon. That this method of eliminating chlorine hydrate troubles meets with indifferent success is generally well known.

Present methods for the prevention of "ice" formation are very successful, and depend upon the warming up of the water supply to the chlorinator tray to the point at which the hydrate cannot form. Several commercial devices are on the market for bringing this about. They supply heat either from electricity, or by heat exchange with steam or hot water. Some plants use home-made "gadgets" utilizing these methods, and report successful operation. In the November, 1940, issue of WATER WORKS & SEWERAGE a home-made electric heater was described by Calderwood.

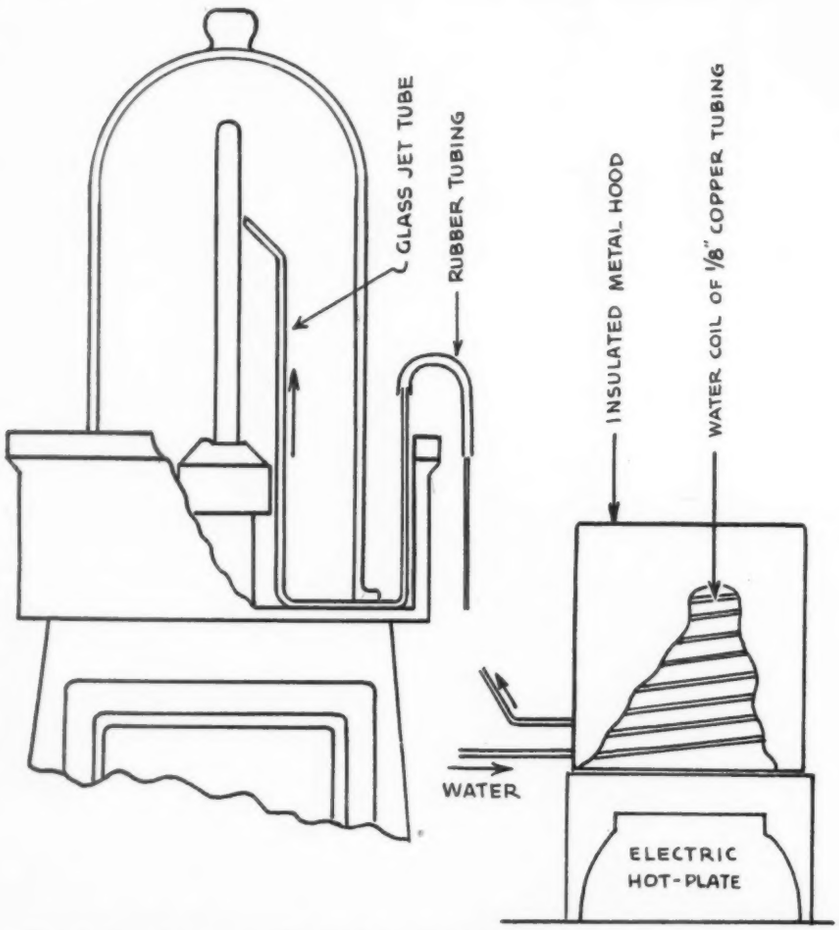


Chlorinator and Jacketed Coil Hot-Plate Heater Set-Up for Winter Operation.

The writer has used a home-made "ice" remover for the past several years. It is simple to make, simple to use, free from trouble, and is very successful in its operation. It has the advantage over most of the water heating methods now in vogue, in that only a very small stream of water needs to be heated, rather than all of the water flowing to the tray of the chlorinator.

The De-Icer

Essentially the device consists of a glass tube throwing a small stream of warm water against the metering tube (see sketch). Ordinary laboratory glass tubing is bent in the form of a U-tube in such a manner that the arm of the tube contained within the bell jar will permit a small stream of water to impinge on the metering tube at a height a little above the expected maximum setting of the machine for the winter season. The end of the tube inside the jar is drawn so that its opening



Sketch Showing Warm Water Jet-Tube Arrangement Under Bell Jar and Inexpensive Continuous Flow Water Heater—Hannibal, Mo., Filter Plant.

is about one-sixteenth of an inch. The distance between the two arms of the U-tube is such that when the inside arm is within a half inch of the metering tube, the outside arm will rest in the front corner of the chlorinator tray. This outside arm should of course extend an inch or two above this tray.

The source of heat used by the writer is an ordinary single burner electric hot plate of the kind now generally sold at practically all chain drug stores for about seventy-nine cents. The one in use at our plant has been in continuous service for three winters and is still going strong. To warm the water, a length of 3/16-inch O.D. copper tubing is wound into a spiral coil of twelve or fourteen turns, with the base of the coil of a diameter slightly smaller than the diameter of the heating element. By means of a rubber tubing connection, the cold water is brought to the copper coil with one-eighth inch pipe and a one-eighth inch control valve. The copper tubing is long enough to extend up to the chlorinator tray where again connection is made to the glass U-tube with rubber tubing. (See sketch.)

To properly warm the water in the coil, this latter is surrounded by a heat-insulated jacket. This jacket was made from a two-pound tin coffee can which was covered, side and bottom, with a one inch thickness of cellular asbestos steam pipe covering. This covering was finished off with ordinary pipe covering linen, and painted over. A slot was left on the side to allow for the ends of the copper coil. This jacket is lowered bottom side up over the coil, and rests on the hot plate, thus completely housing the coil in a heat-insulated oven-like chamber.

The small stream of water issuing from the glass tube is warmed to about 70 degrees, which is more than enough to prevent "ice" from forming on the metering tube. Whenever it is desired to de-frost the rubber float balls under the bell jar, this jar is tilted slightly and the stream of warm water is then directed in any desired position by guiding the U-tube from the outside arm.

The U-tube may be inserted under the bell jar (or removed) by merely tilting the bell jar; thus the chlorinator need not be stopped when installing or removing the device.

Another desirable feature we have found with this heater is that as long as some water is flowing through the U-tube, there is no danger of the water becoming too hot to crack the glass of the metering tube.

P.D.M.'s New Drafting Room

Has Three Times the Light at Half the Cost and Far Less Heat

● Engineers will be interested in the new Drafting Room of Pittsburgh-Des Moines Steel Company at the Neville Island Works, Pittsburgh which has many features worth noting. To us it's a "honey."

Here are some of the details of interest which we have secured from Jack O'Leary, P.D.M.'s General Manager. The cool and shadowless lighting is the center of interest, perhaps.

The drafting room is 37′ x 40′ and provides working facilities for forty draftsmen. The three exterior walls are almost completely made of glass block, the total window area being over 1000 sq. ft., equal to about .703 sq. ft. of window area per sq. ft. of floor space.

The room is illuminated with 51-80 watt twin bulb fluorescent lamps, which consume a total of 5100 watts of electricity or approximately 3.45 watts per sq. ft. of floor space. The illumination is practically uniform throughout the room, being 75 ft. candles at the table top working level. The fluorescent lights are of the white type. The lamp units are suspended from the ceiling on stems having a ball and socket connection at the ceiling so that they hang straight. The lamps are approximately 7′6″ above the floor level.

A point of considerable interest is that the total electrical consumption is about one-half of what it formerly was, while the illumination is *about three times as great.* The lights are so arranged that in all cases there is one 48″ light unit above each end of each drafting table, making the light practically shadowless.

The room is completely air conditioned furnishing constant fresh air ventilation, humidification, winter heating and summer cooling. The cool burning fluorescent lights reduce considerably the air conditioning load.

SEWER RENTAL REGULATIONS UPHELD BY COURT

Power to Shut-off Water for Non-Payment of Sewer Charges Upheld.

The power of a city to shut off water at premises delinquent in sewer rental payments was upheld in a recent decision of the Court of Appeals, Richmond County, Ohio.

In giving the decision favoring Mansfield, Ohio, the court said, concerning the city's power to discontinue one service for failure to pay for another service, that *the sewer and water systems are so closely related as to be considered one transaction,* as the operation of the sewage system is dependent upon the water supply; therefore, it is reasonable to shut off water for nonpayment of a delinquent sewer rental bill. (From A. P. W. A. News Letter.")

LONDO MADE SUP'T AT GREEN BAY

Harold L. Londo, Acting Superintendent of the Green Bay Water Department for the past year and a half, was made Superintendent, effective January 1, 1941.

Mr. Londo is a graduate civil engineer of the University of Notre Dame of the Class of 1924. From 1927 to 1935 he served the City of Green Bay as Assistant City Engineer. In the fall of 1935 he was transferred to the Water Department as Plant Engineer.

Mr. Londo replaces James Church, former Superintendent who is being retained as a Consultant.

NATIONAL DEFENSE AND WATER SUPPLIES

Program Feature of N. Y. Section of A.W.W.A.

Reported by CHAS. R. COX
CHAIRMAN
N. Y. SECTION A.W.W.A.

THE annual winter meeting of the New York Section, American Water Works Association, was held at the Hotel Commodore, New York City, on December 27, 1940, this being one of three sectional meetings held each year. The spring meeting will be held in Syracuse on March 27-28, 1941.

The technical program following the luncheon consisted principally of a discussion of national defense and public water supplies. The discussion was opened by *B. E. Sackett*, Special Agent in Charge, F.B.I., New York City.

According to Mr. Sackett, 10,000 industrial explosions and 37,000 industrial fires occur each year during normal times so that there is no need to conclude that sabotage is occurring just because industrial explosions are receiving publicity at this time.

On the other hand, there is a definite need for attention being given to the protection of industrial plants and water supply systems from sabotage, with the realization that protective measures should be calmly and deliberately planned and not influenced by hysteria. Much is being done behind the scenes to protect industry, he said.

In fact, industrial plants engaged in defense construction have been surveyed by F.B.I. agents especially trained for the purpose in accordance with a Presidential order of September 6, 1939, whereby the facilities of 1600 agencies were made available to industry. Specific advice has been given as to the protection of individual industries and general information has been made available through the distribution of literature of a confidential nature available to industrial leaders, police officials, water supply officials, etc.

Mr. Sackett advised water supply officials to place themselves in the position of those desiring to destroy water supply facilities in order to realize more fully the weakest points in a system, which thereafter should be protected in accordance with a pre-arranged plan and administative procedure developed in cooperation with *local* police officials. Any unusual circumstances or conditions should be reported at once to the F.B.I.

Norman J. Howard of Toronto, Canada, President of the Association, in discussing this subject stressed the importance of planning and organizing for emergencies of all types, because the adequate financing of coordinated protective measures required careful consideration as to many details.

President Howard also reiterated that the present emergency would not in any way influence the convention of the Association to be held in Toronto next June. American citizens may freely travel to Canada, providing they have some identification paper, such as automobile driver licenses, etc.

J. L. Barron, Director of the Division of Sanitation of the Nassau County Department of Health, in discussing this subject, stated that 30 public supplies are serving municipalities in Nassau County, wherein many important industries are located. A wide diversity of conditions govern these supplies so that the only agency capable of coordinating protective measures is the county health department. Records are being collected, therefore, as to facilities and the reserve stock of supplies. Connections between the respective distribution systems are being advocated to assure uninterrupted supply to all communities. Defense agencies are studying needs of the county such as a county health laboratory.

Tobias Hochlerner, Division Engineer, Department of Water Supply, Gas and Electricity, New York City, continued the discussion by briefly describing the water supply system of the city and the defense measures being taken to more adequately protect the supply. The measures con-

sist of guarding and protecting property, plans for emergency operation and coordinating organization. Only citizens are employed by the city and fishing and boating on the reservoirs has been restricted. Consideration is being given to camouflaging important structures, which are difficult to guard. Arrangements have been made for emergency contracts for immediate repairs or improvements which cannot be financed by slower procedures.

Thomas Wiggin, Consulting Engr. of New York City, in discussing Mr. Hochlerner's paper, stressed that little was known as to the effect of large caliber bombing on concrete dams which were readily visible from airplanes. Mr. Wiggin recommended that the Federal Government spend sufficient funds to demonstrate the effect of bombing on a concrete dam constructed for the purpose.

The place of auxiliary supplies in maintaining operation under emergencies was stressed in a paper entitled *"Auxiliary Supply for Mamaroneck and Harrison"* by *William E. Thrasher*, General Superintendent of the Westchester Joint Water Works No. 1. Three municipalities are served by this system, securing a filtered supply from the Mamaroneck River. An additional supply was needed for periods of drought and to insure uninterrupted service at all times, in consequence an auxiliary pumping station was constructed to force water from Rye Lake to the distribution system. Treatment with lime for corrosion prevention and chlorine and ammonia for disinfecting is provided. Three motor driven centrifugal pumps were installed, which may be driven also by two auxiliary gasoline engines. The objection of citizens to the construction of a high standpipe in a residential area resulted in the construction of a lower standpipe with automatic regulating valves. Trees are to be used to hide the standpipe.

HOW TO COMPARE PUMP EFFICIENCIES

By W. F. SCHAPHORST, M.E.
NEWARK, N. J.

If the efficiency of your present pump is 74% and you are planning to install a new pump whose efficiency will be 85%, the improvement will not be merely 11%. There will be an improvement of 13% in efficiency.

It is not uncommon for users and prospective users to subtract the efficiency of the old pump from that of the new one and call the difference the "improvement" in efficiency, but that is not correct. The correct method is to subtract the two efficiencies and then divide the difference by the efficiency of the new pump.

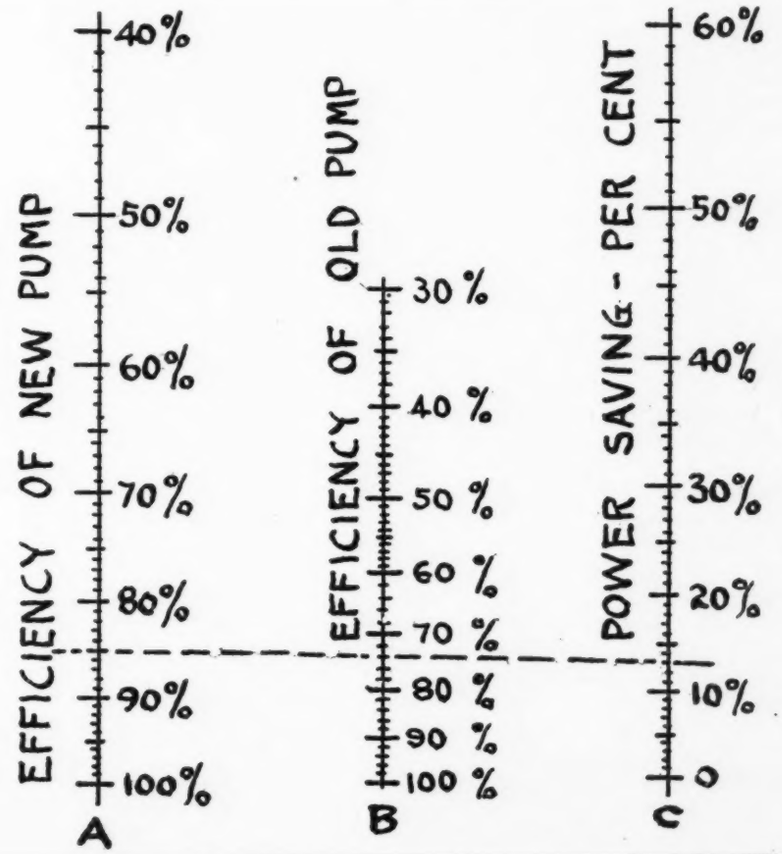
Thus, for example:

$$0.85 - 0.74 = 0.11$$
$$0.11 \div 0.85 = 0.13$$

which verifies the figures given above.

Let us suppose that you have a pump whose efficiency is only 40% and you are contemplating the installation of one whose efficiency will be 80%. The difference between the two efficiencies is 40%, but that is not the correct improvement. The true improvement is $40\% \div 80\% = 50\%$.

Herewith is a chart that gives the true improvement or "power saving" without any longhand figuring whatever. Simply run a straight line through the efficiency of the new pump, column A, and the efficiency of the old pump, column B, and the power saving or improvement in efficiency is instantly given in column C. Thus the dotted line drawn across this chart shows that where the efficiency of the new pump is 85% and that of the old pump is 74%, the improvement which can be expected in power saving is 13%.



How Hydrants Came to be Called "Fire Plugs"

The Engineering Experiment Station News, Ohio university, gives the following version of "How the Fire Plug Got its Name."

The first cast-iron water main in the U. S. was laid in Philadelphia in 1817 with pipe imported from England.

The best water pipes previous to cast iron were those made of wood. In the smaller sizes, the best of these were bored out of elm logs with bark left on. Under favorable conditions, these pipes would last around 20 years. Larger size pipes were made from staves bound together with iron. In the case of a fire, the firemen would simply dig down to the water main and chop a hole in the pipe and water for the pumps would be taken from the pool of water that formed immediately. After the fire, the hole was stopped with a wooden plug and the pipe covered again. In some cases, the location of these holes would be marked so that, in case of another fire, the same hole could be found and the plug removed so as to avoid injuring the pipe further by chopping another hole.

The Editor's Comments

The World's First "Super-Colossal Chlorinator"
(*An Innovation of* 1940)

WELL known for his adeptness at ferreting out the more important developments of the year, Norman J. Howard's review of water supply progress in 1940, featured in this issue, has entailed the examination of 400 individual magazines and journals. If the reviewer has overlooked anything worthy of note, such may be attributed to the fact that, as President of the A. W. W. A., most of his time late in the year was spent hopping over the country in aeroplanes attending sectional meetings.

In view of the rapidity and avidity with which superchlorination of water has been taken up by water works authorities during the year, we feel that it has been a happy coincidence that Norman Howard was the chosen reviewer of 1940 water supply progress, for he has an indisputable claim to the title of "Father of Superchlorination in America." We say America because we know that he considers the real "Father of Superchlorination" to be his "patron saint," the pioneering leader under whom he received that inspiration which led to his coming to America, and, shortly thereafter, in making water treatment history. This scholar was the beloved late Sir Alexander Houston, Director of Laboratories of the vast Metropolitan Water System of London.

Howard had never forgotten the axiom of the "master," who always warned that, when in difficulty with tastes created by or intensified by chlorination of waters, "chlorine temerity" was the absolutely wrong antidote. Instead, he preached loudly and widely that the most certain of correctives was to be found in evincing "chlorine boldness," which meant running up the dosage to a point where the least objectionable of these tastes (quaintly referred to as a "mawkish" taste), to the worst of the by-product tastes, were obliterated or brought to a minimum. But he always cautioned that half-way measures were worse than none when it came to chlorination of water.

So, after Howard came to America on recommendation of Sir Alexander to take the position of Director of Purification at Toronto, and had not long been on the job before running into some very "mawkish" tastes in the chlorinated water of Toronto, he set about to find the remedy. In following his old "master's" dictates, superchlorination proved the measure that clicked. This was roughly 14 years ago, and after a sufficient laboratory demonstration on a great variety of tastes under various conditions, Toronto believed enough in Howard to put in the world's first superchlorination and dechlorination plant of any consequence. This plant has continued in operation there 12 or 13 years since.

To this writer, the great Britisher [knighted Sir Alexander because by introducing chlorination of London's supplies had saved his country thousands of tons of coal regularly required for pumping to self purification storage reservoirs when so sorely needed by Britain in waging the first World War] was also something of a "patron saint." His reasoning and predictions possessed appeal, and several tests of his "chlorine boldness" preachings had proven to the writer's satisfaction that this axiom was a sound one in every case tried. As the result, the Houston recommendation was written into and emphasized in the chapter "Chlorination" appearing in the first Manual of Water Works Practice published by A. W. W. A. Soon thereafter the results of the work of Howard, and his capable staff members in Toronto, furnished added evidence.

The natural question is after its success at Toronto what delayed the spread of superchlorination until the past year. Howard, in noting its present popularity, justifiably remarks, "It seems strange that it has taken some fourteen years to sell superchlorination treatment," especially considering its twelve years of successful use in Toronto on a large scale. If we were asked to give the most likely answer we would say that the advent of ammoniation, which was acclaimed at about the same time as superchlorination was established in Toronto as being the less costly and equally effective of the two processes, is what temporarily stopped the spread of superchlorination. However, time remains the great "telling agency" and now full appreciation is had that while ammoniation has a very beneficial place in water treatment, it is properly the *modifier* for the residual chlorine, and by no means the *corrective* that the destructive and oxidative superchlorination method has proven to be.

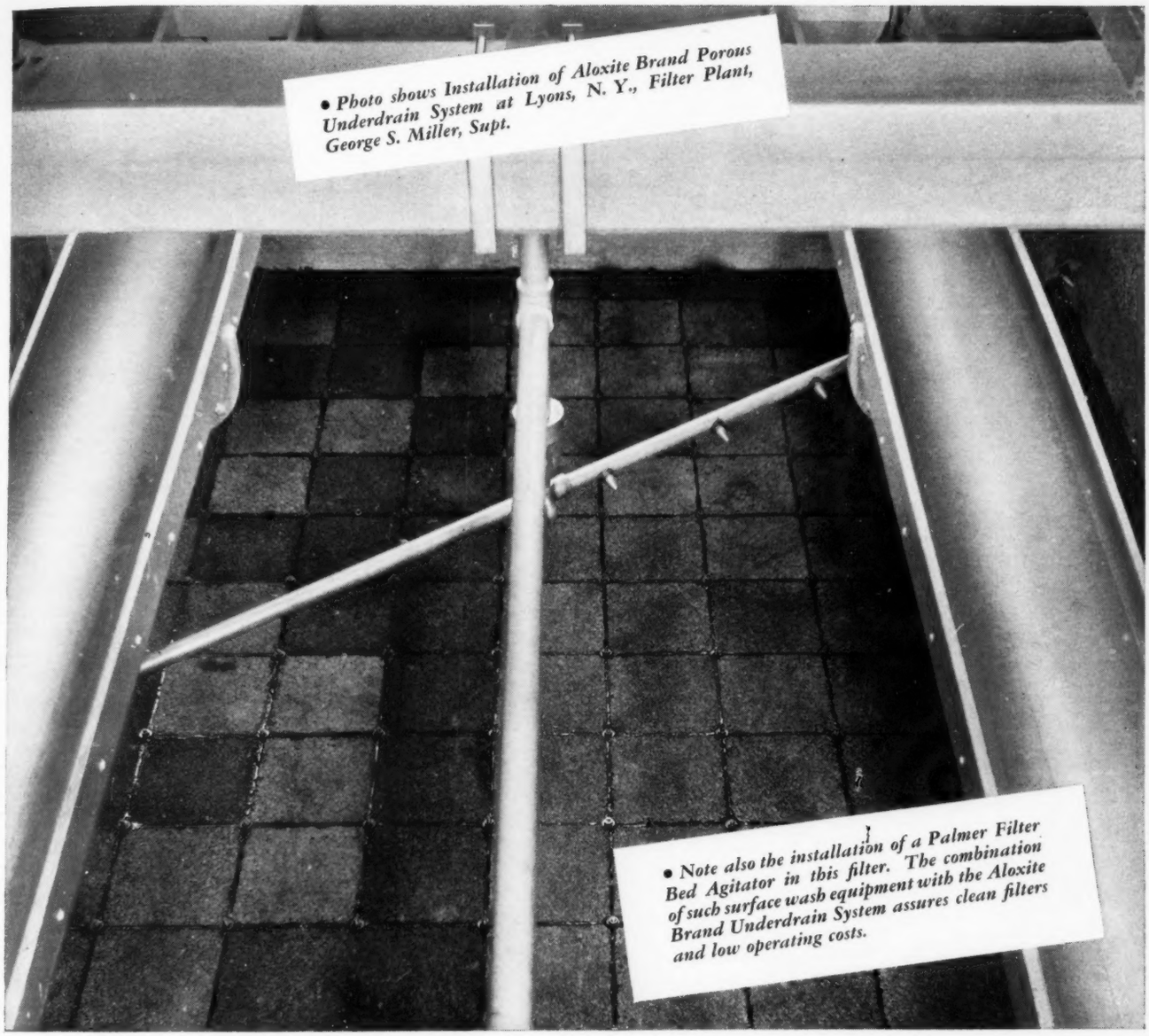
And today we have before us the question, "What constitutes superchlorination?" Who knows? However, the lack of a true yardstick to determine how far to proceed with superchlorine dosages to effect desired results has been greatly remedied by the advent of the "break-point" method of dosage determination. It has been shown, though, that many waters do not exhibit the "break-point" indication of chlorine sufficiency, but none the less results of super-dosages by the cut and try methods of evaluation have been on a par with attainments secured through control by the "break-point" method announced by Wallace and Tiernan Co. during the year. To many, however, this new yardstick has proved a great boon and the simplest index to be had of the first safe stopping point in heeding the admonition of water chlorination's "patron saint"—that stopping at some point short of goal in superchlorination practice spells defeat and sorrow to he who lacks the necessary "chlorine boldness" to carry through.

We may say that without the "break-point" method as a guide there would have been no "Super-Colossal Chlorinator" in the West to make water treatment history in 1940. Manager Horace A. Brown of the Ottumwa, Iowa, Water Department, could hardly have been persuaded, we think, to start his superchlorination program at something better than 112 p.p.m. dosage without the series of tests conducted all night in the laboratory to find the "break-point," but recently advocated at the time. It was hard for a water-works man to conceive of 112 p.p.m. chlorine in anybody's water. It wasn't even done in sewage chlorination, much less a city's drinking water, but there was the evidence from the "break-point" tests; and in went the 112 parts, through the heroic feeding procedures required, to clear up apparently the toughest situation on record that a water-works manager has ever faced in the way of pollution and taste troubles.

Water treatment history was made in 1940 when bold front-page news headlines heralded "Super-Colossal Chlorination" at Ottumwa, and Manager Brown overnight became the world's outstanding exponent of "chlorine boldness."

L. H. Enslow

ANOTHER MONEY SAVING ALOXITE BRAND POROUS UNDERDRAIN INSTALLATION (THE 57th TO DATE)


• Photo shows Installation of Aloxite Brand Porous Underdrain System at Lyons, N. Y., Filter Plant, George S. Miller, Supt.
• Note also the installation of a Palmer Filter Bed Agitator in this filter. The combination of such surface wash equipment with the Aloxite Brand Underdrain System assures clean filters and low operating costs.

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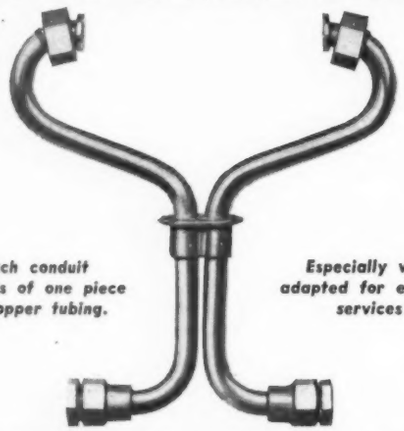

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MEETINGS SCHEDULED

Jan. 15-17—NEW YORK CITY, N. Y. (Engineering Societies Building)
American Society Civil Engineers. Annual Meeting. Sec'y., George T. Seabury, 33 West 39th Street, New York City.
(Jan. 16—Sessions of Sanitary Engineering Division)
(Jan. 17—Joint Dinner of the Division and N. Y. Sewage Works Ass'n.)

Jan. 17-18—NEW YORK CITY, N. Y. (Hotel McAlpin)
New York State Sewage Works Ass'n. Sec'y., A. S. Bedell, State Board of Health, Albany, N. Y.
(Jan. 17—Joint Annual Dinner with San. Eng. Div. of A.S.C.E.)
(Jan. 18—Joint inspection trip with San. Eng. Div. of A.S.C.E.)

Jan. 20-24—STILLWATER, OKLA.
Oklahoma Water & Sewage Conference. (Annual Meeting). Secretary, H. J. Darcey, State Dep't of Health, Oklahoma City, Okla.

Jan. 23—NEW YORK CITY, N. Y. (Engineering Societies Building)
American Society of Mechanical Engineers. (Evening Meeting Sanitation Group) Chairman, Wm. Raisch, Consulting Engineer, 227 Fulton St., New York, N. Y.

Feb. 19—NEW BRUNSWICK, N. J. (Roger Smith Hotel)
New Jersey Section A.W.W.A. (Winter Meeting.) Secretary, C. B. Tygert, Box 178, Newark, N. J.

Feb. 20—BOSTON, MASS. (Hotel Statler)
New England Water Works Association. Secretary, Frank J. Gifford, 613 Statler Bldg., Boston, Mass.

March 20-21—TRENTON, N. J. (Stacy-Trent Hotel)
New Jersey Sewage Works Ass'n. (26th Annual Meeting) Treas., Paul Molitor, Jr., Box 374, Morristown, N. J.

March (tentative)—LAWRENCE, KANS.
Kansas Water & Sewage Works Ass'n. Sec'y-Treas., Earnest Boyce, State Board of Health, Lawrence, Kans.

March 21-23—YUMA, ARIZONA
Arizona Sewage & Water Works Association. Sec'y-Treas., F. C. Roberts, Jr., State Sanitary Engr., Board of Health, Phoenix, Ariz.

March 27-28—SYRACUSE, N. Y.
New York Section A.W.W.A. Secretary, Rollo K. Blanchard, Neptune Meter Co., 50 West 50th Street, New York, N. Y.

April 21-23—QUINCY, ILL.
Illinois Section A.W.W.A. Secretary, H. E. Hudson, Experimental Filtration Plant, Chicago, Ill.

April 24-25—INDIANAPOLIS, IND.
Indiana Section A.W.W.A. Secretary, Herman G. Horstman, Superintendent Water Distribution, Public Service Co. of Indiana, Traction Terminal Bldg., Indianapolis, Ind.

May 8-10—SEATTLE, WASH.
Pacific Northwest Sewage Works Ass'n. Secretary, Fred Merryfield, Oregon State College, Corvallis, Ore.

May 12-14—CHARLESTON, S. C. (Fort Sumpter Hotel)
Southeastern Section A.W.W.A. Sec'y-Treas., B. P. Rice, R.F.C. Healey Bldg., Atlanta, Ga.

May 15-16—CINCINNATI, OHIO.
Ohio Section A.W.W.A. Secretary, T. R. Lathrop, State Dept. of Health, Columbus, Ohio.

May 16—MISSOULA, MONT.
Montana Section A.W.W.A. Sec'y-Treas., H. B. Foote, Helena, Mont.

June 22-26—TORONTO, ONT., (Royal York Hotel)
American Water Works Association. Annual Convention. Secretary, Harry E. Jordan, 22 E. 40th St., New York, N. Y.

Sept. 1-3—STATE COLLEGE, PENNA.
Pennsylvania Water Works Operators' Association. Sec'y-Treas., I. M. Glace, 22 South 22nd St., Harrisburg, Pa.

Oct. 13-16—FORT WORTH, TEXAS
Southeast Section A.W.W.A. Secretary, L. A. Quigley, Supt. City Water Works, Fort Worth, Texas.

Oct. 22-25—FRESNO, CALIF. (Hotel Fresno)
Secretary, B. S. Grant, Department of Water & Power, Box 3669, Terminal Annex, Los Angeles, Calif.

Nov. 6-7—BALTIMORE, MD.
Four States Section A.W.W.A. Secretary, Lloyd Nelson, U. S. Pipe and Foundry, Broad and Chestnut Streets, Philadelphia, Pa.

LITERATURE AND CATALOGS

"Valves, Valves and More Valves—All Automatic" are presented in a new 96-page profusely illustrated and handsomely produced catalog, of which the Golden-Anderson Valve Specialty Company of Pittsburgh can take just pride. General Catalog No. 26, as the name implies, presents the complete line of the many types and styles of automatic control valves which the manufacturer has been producing exclusively during a period of 35 years of specializing in this type of equipment, long and well known in water and steam service. The user of Catalog No. 26, with its 32 different types and styles of Altitude; Pressure Reducing; Pressure Regulating; Pressure Relief; Automatic Checks; Trip Valves; Air Reducing and Regulating Valves, with applications cited, is invited to submit his specific problem for special study in case nothing presented appears to fill requirements. Thus is Golden-Anderson's specialty engineering service emphasized. Because of its very completeness this new catalog is the more difficult to effectively review; and, we rest with a recommendation that every designing engineer and water works operating head should make certain that his office has a copy available. Furthermore, to study it is in itself educational. For a copy of General Catalog No. 26 "Automatic Valves," write Golden-Anderson, Fulton Building, Pittsburgh, Pa.

"Straightline—Grit Collectors and Washers" are subject of a new folder from Link-Belt Co., which pictures, describes and gives capacities of the several sizes of these "Straightline" grit handling units. It presents pictures of typical installations at important modern sewage treatment plants and also describes the Link-Belt "Tritor," which is a combination bar-screen and grit-chamber with cleaning mechanism automatically controlled, for the smaller and medium sized plants. For a copy of this new bulletin request Folder 1942 of Link-Belt Co., 2045 Hunting Park Ave., Philadelphia, or 300 W. Pershing Road, Chicago.

"Rotary Distributors—by P.F.T." are presented in a new 24-page bulletin from Pacific Flush Tank Co. of Chicago. This bulletin cites the advantages of rotary distributors and presents design details of the "P.F.T." distributor, emphasizing the improved bearings, positive mercury seal and the unique (patented) P.F.T. Spreader Jet. Each feature is treated in some detail and typical design drawings are reproduced. Reproductions of photographs of going installations are impressive, including that of the largest rotary distributor installation in America—at Dayton, Ohio. The P.F.T. Double Flow Distributor for the smaller plants handling marked variations in sewage flows is also emphasized. The last two pages are devoted to other well known equipment manufactured by "P.F.T.," who is careful to remind the reader that this long established firm still produces fixed filter spray nozzles. For a copy of bulletin No. 213, write

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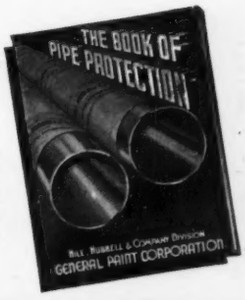

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"Service Life of Coal Tar Enamel Coatings" is an article by Harry Hayes of the Los Angeles Department of Water Supply, reprinted from the Journal of A.W.W.A., and distributed by The Barrett Company. It is believed that no other user of coal tar enamels has gone so exhaustively into these protective coatings as have the Los Angeles investigators. Therefore, the results of their studies, reported by Mr. Hayes, the specifications developed, and conclusions reached, that the improved enamels properly applied will stand a phenomenal amount of abuse and may be expected to supply protection permanently, are worthy of attention. This, says the author, is in answer to a frequently raised question concerning coal-tar coatings and linings—"How long will they last?" For a copy of this informative reprint, write The Barrett Co., 40 Rector St., New York City.

"% Proportioneers % Defense Folder" is done in red, white and blue to indicate that it presents water purification and sewage treatment equipment of especial interest in the present defense plans under way in this country. It contains information on the regular line of % Proportioneers % chemical feeders, plus specialty equipment such as the complete portable midget filter and purification plants and sewage treatment units. Copy of bulletin "DEF" can be had from % Proportioneers % Inc., No. 9 Codding St., Providence, R. I.

"Sewage Disposal Problems" is an illustrated condensed folder which at a glance gives the reader a summary view of where various sewage equipment produced by Chicago Pump Company fits into the sewage disposal field, with particular reference to speed of installation required in the defense program now under way. For a copy of Folder 30, write Chicago Pump Co., 2300 Wolfram St., Chicago, Illinois.

"Painting for Defense" is interestingly featured in a 7-page article in New Jersey Zinc Company's January issue of "Paint Progress." The article tells the volume of paint involved and what paints will be used and where applied in defense preparedness. This information is useful and timely. For a copy write New Jersey Zinc Co., 160 Front St., New York City.

"Welding Procedures" for welding various metals are given in a new 58-page brochure of 165 illustrations from The Lincoln Electric Co. The procedures, which cover all types of welding, include: recommended current ranges and arc voltages; suggestions regarding arc length, polarity of welding current, distance to hold electrode from work, cleaning beads, welding up or down, use of wide and narrow beads, peening to increase hardness, quenching, weaving the electrode, etc. Properties of welds produced in various metals are given and typical welding applications are illustrated. A valuable feature of the new bulletin is a chart serving as a guide for selection of electrodes for various applications, in addition to a discussion of flat, convex and concave beads. An additional feature, which will be found helpful to all users of welding, is a 2-page illustrated section giving information and pointers on the proper use of modern shielded arc welding. A 10-page section covers the subject of surfacing with arc welding and includes a chart for selection of electrodes for particular applications, together with detailed procedures for this important branch of welding. Of value to all users of welding,

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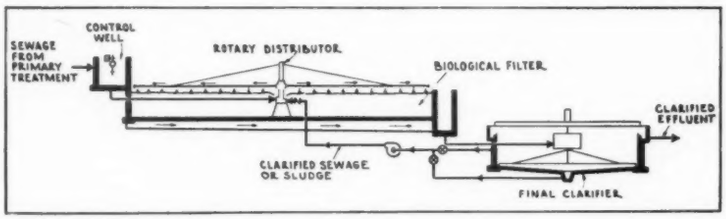

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"The Lincoln Weldirectory" may be had by writing The Lincoln Electric Co., Cleveland, Ohio.

"Silica Removal by an Improved Magnesia Process" is a preprint of an article by H. L. Tiger, distributed by The Permutit Company, which describes a now well proven process for effectively removing destructive silica from boiler feed waters. For a copy write The Permutit Co., 330 West 42nd St., New York City.

"Water Proofings and Leak Stopping Compounds" are the subject of a folder from Sherwood Water Proofing Corporation. It presents full information on "R.S.P." Asphalt Cold Water Emulsion for waterproofing and "R.S.P." Plastic Compound applied cold for stopping leaks in masonry structures, drain lines, roofs, etc. For further details concerning these handy materials, request this folder of Sherwood Waterproofing Corp., 53 Park Place, New York City.

New Plumbing Manual—A new manual of recommended plumbing practice prepared by a committee representing Federal agencies concerned with this subject was released recently by the National Bureau of Standards, Department of Commerce. In the preparation of the manual due consideration was accorded available recommendations of other bodies, as well as results of research in the Bureau's laboratories.

Part I of the manual is an introduction explaining the origin of the work. Part II contains recommendations regarding necessary sizes of piping, precautions against possibilities of pollution of water supply, permissible types of venting, and other matters customarily covered in plumbing codes. Part III contains information useful in applying the recommendations, including illustrative interpretations of the specific requirements in Part II.

The recommendations are presented as suitable for adoption by Federal agencies engaged in actual plumbing work or in passing upon plans of structures containing plumbing.

Copies of the report issued as BMS 66, are obtainable at the nominal cost of 20 cents each from the Superintendent of Documents, Government Printing Office, Washington, D. C.

"Federal Steel and W. I. Pipe Specifications" of the most recent date (July, 1940) have been reproduced in booklet form for distribution by a manufacturer of steel and W. I. Pipes. For a copy address Republic Steel Corporation, Cleveland, Ohio.

"Anthrafilt—Manual of Information," a production of The Anthrafilt Corporation was compiled by Professor H. G. Turner of State College which very effectively and fully tells the "where, how and why" of anthrafilt as a filtering media. It propounds and answers many questions pertaining to basic considerations in choice of a filter material. For a copy, write The Anthrafilt Equipment Corp., 19 Rector St., New York City.

"Dorrco Methods" is largely pictorial in its attractive method of presenting to the reader what's behind the shop doors of The Dorr Company. It reveals Dorrco production methods and manufacturing facilities, in which mass production and standardized designs are not material factors in what is largely a specialty business involving "tailored" equipment for the most part. The 14 year old plant in Denver is manned by employees 98% American. If you wish to glimpse behind the shop doors of this important American corporation a copy of "Dorrco Methods" will be sent you by The Dorr Co., Inc., 570 Lexington Ave., New York City.

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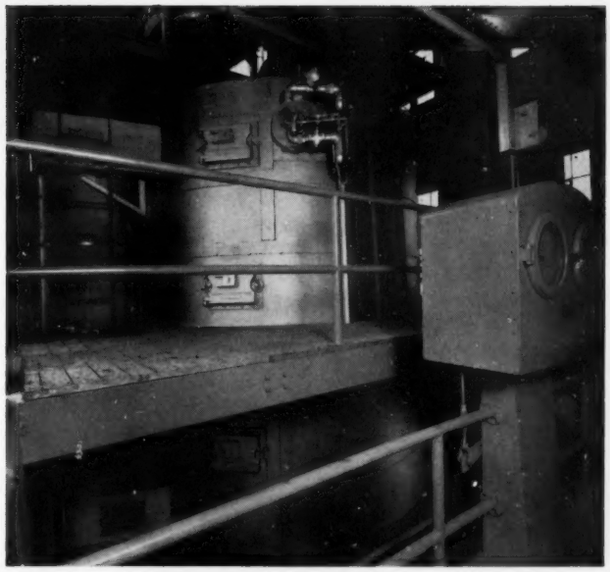

View showing Rutherford, N. J. installation. Chas. Kupper, Bound Brook, N. J., Consulting Engr.

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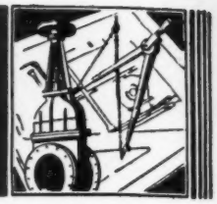

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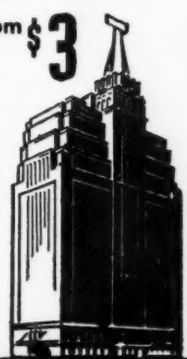
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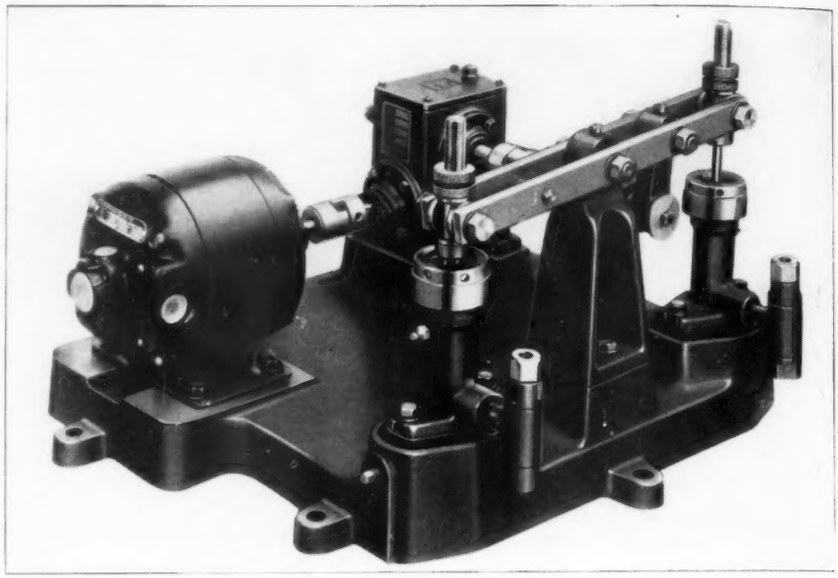
EQUIPMENT NEWS

New Hills-McCanna Proportioinng Pump



● Hills-McCanna Co., Chicago, announces the new "R" Type Proportioning Pump, developed to provide a pump in the low price field which offers small capacity at reasonably high working pressures.

Compact, rugged construction has been engineered into this design so as to assure long, trouble-free service at pressures as high as 1200 pounds per square inch. Capacities per feed are variable from a few drops per stroke, utilizing a 5/16" plunger, to as high as 8 gallons per hour with a ¾" plunger.

Liquid ends are, of the plunger displacement principle and incorporate outside, vertical composite type check valves, which are available with either single or double suction and discharge. This unique check valve is designed to eliminate vapor lock and pressure drop through the check as well as promote the handling of solids in suspension.

The "R" Pump is of the constant speed, variable stroke type—capacity variations being effected by means of adjustable plunger buttons. This pump can be had in single or multiple feed assemblies.

For a more exact description request literature from Hills-McCanna Co., 2349 Nelson St., Chicago.

Brookville Diesel Locomotive

● A new series of Brookville locomotives, in 4, 5 and 6 ton weights, is now available with the UD-6 International Diesel engine. This engine, recently introduced by the International Harvester Co., is a four-cylinder, four-stroke cycle, full Diesel, developing 39 hp. at 1500 r:p:m:

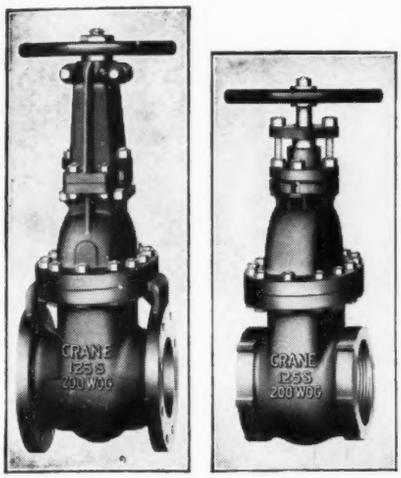
As used in the Brookville locomotive, the UD-6 Diesel engine makes an ideal locomotive power plant. Its high torque at slow speeds give it the lugging ability of a steam engine. Its smooth flow of abundant power is applied efficiently to all four locomotive drive wheels through four forward and four reverse speeds, the latter of which are made available by the Brookville reverse gear operating in conjunction with a heavy duty, four-speed transmission. The work capacity of the locomotive is further increased by the use of steel tires, said to increase traction by a full 25 per cent over chilled face drive wheels.

Other features of the Brookville locomotive include: dual spring journal suspension, which permits high speed over poor track; an indestructible steel frame; Timken bearings; and use of standard "International" parts in the engine clutch and transmission, to permit field service by any International Harvester branch.

For a bulletin describing the new locomotive, write the Brookville Locomotive Co., Brookville, Pa.

New Iron Body Wedge Gate Valves by Crane

• A new and complete line of standard iron body wedge gate valves for 125 lbs. steam, or 200 lbs. cold working pressure has just been brought out by Crane Co. This new line includes both the brass trimmed and the all iron patterns with O.S.&Y., or non-rising stem, in sizes 2 to 12-inch, inclusive. Also, the quick opening and the Underwriters' patterns, the alloy trimmed, and alloy cast iron valves for process work.



Among the important features of these new valves is the redistribution of body and bonnet materials, which eliminates all excess weight and yet complies with all standard requirements. Handwheels are of strong malleable iron; deep stuffing boxes permit a generous amount of packing; the body-bonnet joints employ a flat gasket closely bolted together so that gasket compression is evenly distributed; seat rings are of the shoulder type to retain tight contact with the body in spite of the difference in expansion characteristics; stems, threads, bolt holes, nuts and bolts, in fact, all machined parts, are precise in their fit and finish, which reflect the careful workmanship and high quality built into them.

A new booklet (A. D. 1452) will be mailed on request. Address any Crane branch, or Crane headquarters at 836 S. Michigan Ave., Chicago.

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- **No jute used—gasket centers spigot.**
- **Definite space in each joint for cement.**
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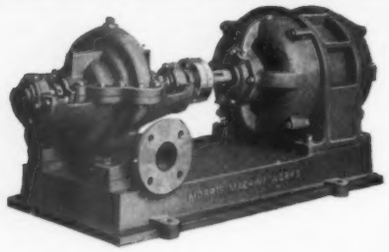
The MORRIS HYDRAULIC COLUMN

News of interest to Centrifugal Pump Users



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A southern plant needed more pumping capacity. The engineer came to Morris for advice. The result—a single stage Morris Pump which gave them 50% more water at the same head as from the old two-stage pump, *using the same motor as before.* If you need more capacity, or if your pumping costs are high, investigate Morris designs for your requirements. Seventy-five years of centrifugal pump-building experience makes Morris recommendations authoritative.

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Morris Sewage Pumps prevent clogging troubles, and assure continuous trouble-free operation even when handling heavy pulp and trash. They are extremely efficient, and have heavy wearing parts that minimize renewal expense, and the inside is easily reached.

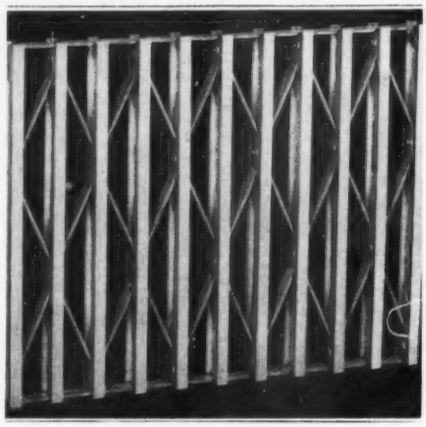
These units are built both vertical and horizontal, for direct connection to standard-speed motors, and in sizes ranging from 3 to 30 in.

Larger axial flow and screw pumps are also built, with efficiencies well above 90%.

MEMBER

For authoritative recommendations on any pumping or dredging problem, write to Morris Machine Works, Baldwinsville, N. Y. Representatives in principal localities. *Export Office,* 50 Church St., New York.

Light Weight Aluminum Alloy Graitngs



● The Stamford Metal Specialty Co. Stamford, Conn., announce that they are now fabricating metal trim, gratings and other specialties and accessories employed in sewage and water plants. This company produced the attractive gratings employed in the new Sewage Treatment Plant at Springfield, Mass., and the above picture was made of one of the sections of gratings in this plant. They are fabricated from an aluminum alloy.

The advantages claimed for aluminum or aluminum alloy gratings are that they do not corrode and require no maintenance; always look neat and clean; are light in weight and therefore easily handled in larger units by one man; yet, they are strong and of durable construction. The Stamford Gratings have groved non-skid treads on both sides, making it reversible when wear justifies such eventually.

For further information write—Stamford Metal Specialty Co., 738 Main St., Stamford, Conn.

Leak Location with "Test-A-Tone"

● Aptly described as "the engineer's stethoscope," the TEST-A-TONE has been found as useful in locating water pipe leaks as in checking up on moving parts of machinery. The device is very simple in both construction and operation; and, though non-electric, is provided with a volume control which permits sound reduction to any desired strength and helps to eliminate background noises. In examining sounds of great intensity, rubber tips may be used in place of the all-metal rod.

Among machine uses mentioned by the manufacturer are the check up of valves and bearings in reciprocating engines, blade rub in turbines, combustion knocks, piston slap, bearing knocks and valve gear tests in diesel and gasoline engines, and the checking of compressors, steam traps, and miscellaneous bearings. Application to water systems covers both mains and services. Full information may be had from TEST-A-TONE Company, 274 Madison Ave., New York, N. Y.

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EDSON'S NEW HAND PUMP

Smallest Diaphragm Pump Made, 2" Suction Open Discharge. Capacity 1400 G.P.H. Weight 50 lbs.

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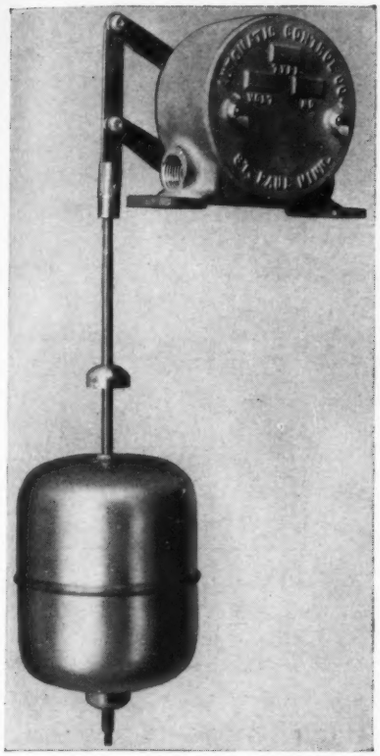
Catalog "T" Gives Full Data, Also Edson Hand and Power Pumps, Suction Hose and Pump Accessories

New Type Float Switch

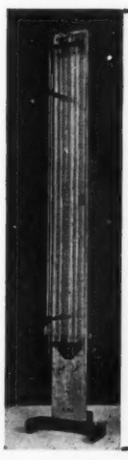


● The new Type J. float-switch recently developed by Automatic Control Co. of St. Paul, Minn., has several features of interest, and is designed and packaged especially with the man in the field in mind.

It is constructed of non corrodible materials and employs a snap action mercury switch. They come in two styles —one being rod operated and one with cable suspended float and counter weight. It may be mounted on a pipe or on a wall, the package containing everything needed for either mounting. The switch enclosure comes as weather proof "standard," or in "explosion proof" design at but slight added cost.

The switches have reversible contact for use in pumping-in or pumping-out operations.

A descriptive leaflet gives more details. For a copy write Automatic Control Co., 1005 University Ave., St. Paul, Minn.



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Base weighing 12 pounds can be removed, permitting wall mounting. Well constructed throughout. Art Metal Finish.

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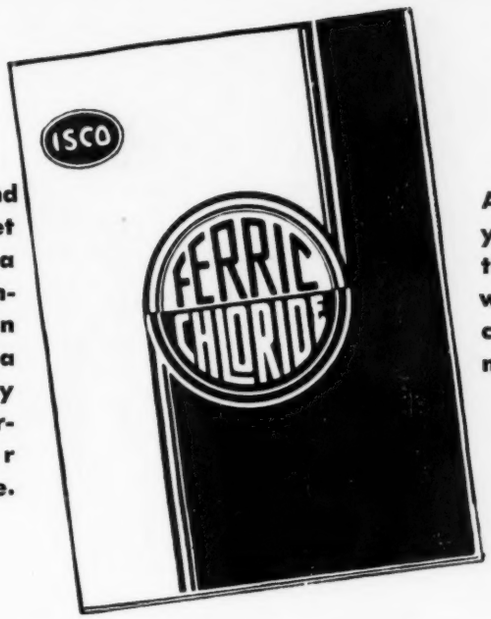

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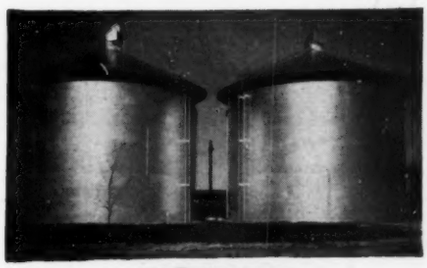

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Write for your free copy today.

GOLDEN-ANDERSON VALVE SPECIALTY CO.

1329 Fulton Building
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"Stepped-Up" Durakool Switches

● To meet a growing demand for larger electrical capacities with smaller overall mechanical dimensions, Durakool, Inc., of Elkhart, Ind., announces two radically new "Stepped-up" mercury switches of the well known unbreakable metal construction. Both switches (No. A-5M and No. A-10Z) have new and novel internal construction characteristics that enable them to carry substantially greater currents than previous Durakool Switches of the same dimensions.

The fore-runner Durakool Mercury Switch (A-5) was rated for 200 watts A.C. lamp load at an operating speed not to exceed 20 times per minute. The new A-5M switch, although having the same physical dimensions as the A-5, has successfully withstood 750,000 operations on a 500-watt A. C. lamp load at an operating speed of 5 times per minute 24 hours a day. It has also taken 50,000 operations on a 1,000-watt D. C. lamp load at a rate of 25 times per minute. The performance of the new A-10Z switch is equally impressive when compared to the standard A-10 Durakool switch.

The A-5M has a very small required angular tilt for operation, and is especially adapted to snap acting mechanisms, as well as tilt action under heavy overload. The A-5M, although priced only slightly higher than the standard Durakool A-5 (5 ampere switch), can be used in a great many applications which formerly required the A-10 (10 ampere switch). Similarly, the A-10Z, at a slight increase in price over the A-10, can be used in many applications where formerly the much larger physical dimensioned A-20 (20 ampere switch) was required.

The makers believe that these two new switches, bringing larger capacities to smaller physical dimension, will open up many new uses for mercury switches where previously the cost and size discouraged their use. For full details, write Durakool, Inc. (Dept. W. S.), Elkhart, Indiana.

STOP

JOINT LEAKAGE
with CARSON
MECHANICAL JOINTS

● CHARCOAL IRON BOLTS ●

for Cast Iron Pipe and Fittings
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IF Your SEWAGE effluents are high in suspended solids;

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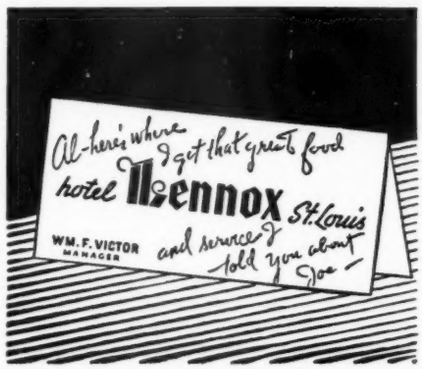
Or, are in any way interested in the removal of suspended solids from liquors;

You should investigate the

Laughlin Modified Rapid Sand Filter

BECAUSE, it is a simple automatic, continuous flow apparatus, designed on familiar lines, to accomplish a purpose without adding to the operator's troubles.

LAUGHLIN EQUIPMENT CORPORATION
270 Madison Ave., New York City



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All rooms have private bath and guest-controlled radio. Rates: 50% of all rooms $3.50 or less, single; $5.00 or less, double.

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Nearby Parking and Garages

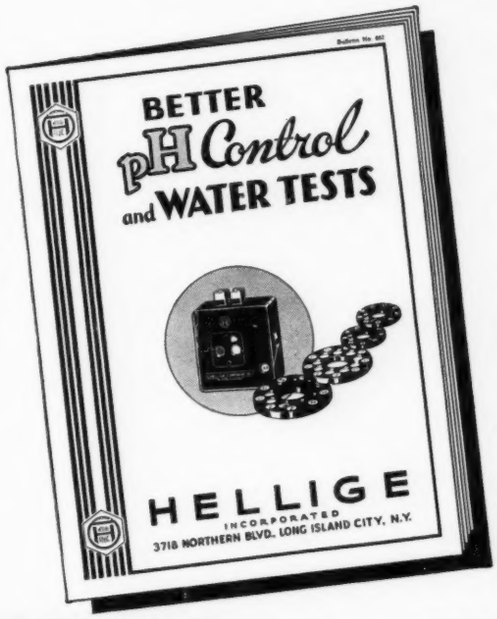
Improved Oil Filter Features Oil Heating

• The Dushane Company, Inc., Chicago, has just released details about their new oil filter for motor cars, trucks, diesel and gas engines of all types. Called the Percolex Oil Clarifier, this new device is said to not only thoroughly filter motor oil and refine it, but maintains it at a constant temperature most satisfactorily for effective lubrication. It utilizes the cooling system of the engine to maintain oil at the proper temperature, winter and summer.

This new "refinery type" filter contains fuller's earth, a series of screens, cotton waste, jute and other filtering media which keep the oil clarified and in perfect lubricating condition. These filtering elements are similar to those used in oil refineries. The oil is said to pass through a total of six distinct clarifying agents which remove water, acids, sludge, sediment, carbon, and other impurities.

A bulletin describing the Percolex Oil Clarifier can be had by writing the Dushane Company, Inc., 14 North Clinton Street, Chicago.

WRITE TODAY FOR THIS INFORMATIVE FREE 28-Page BULLETIN No. 602!



A study of this bulletin would be to your best interest, as it would enable you to form an intelligent judgment as to what is best suited for a particular purpose in extending present equipment or in planning for an initial installation.

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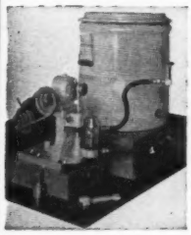

Outstanding features are quick feed adjustment, visible valves, flexible cylinders; feeds against 150-lb. pressure, and proof against corrosive chemicals.

Motor driven, positive displacement, pump type feeder. It is illustrated as a constant rate feeder though also furnished as Type MD-H with fluid meter control, and when so arranged is a measure-to-measure proportioning feeder.

This is a sturdy, dependable heavy duty feeder.

Write for Bulletin

Wilson Chemical Feeders, Inc.
BUFFALO, NEW YORK

The Meter-Master

RATE RECORDER FOR WATER METERS

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246 Palm Street, Hartford, Conn.

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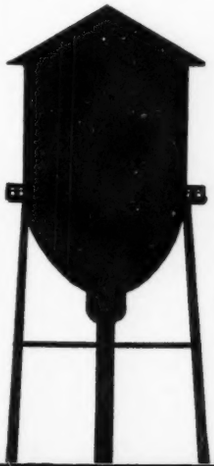
RUST eats away the INSIDE of your STEEL TANK relentlessly and ceaselessly—STOP IT—with

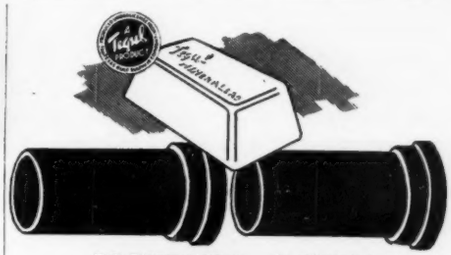
RUSTA RESTOR
(Electric rust-prevention method)



Saves its cost in about two years in an average-size tank; about four years in a small elevated tank; and saves its cost in only one year when used in the largest tanks.

Write for Literature

RUSTA RESTOR CORP.
1480 W. State Street
FREMONT OHIO



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Delays in laying—traffic risks maintained—hold-ups when compound gets wet—chemical changes in compound, entailing trouble—any or all of these may boost your expected cost • Avoid them by using Tegul-MINERALEAD • Initial leakage seals in a fraction of usual time; back-filling can proceed at once. You can stack Tegul-MINERALEAD outdoors, and downpours and floods won't cause you a moment's worry • Coming in ingots, this compound can't change composition • Its initial cost, too, will be a pleasant surprise • More information on request.

The ATLAS MINERAL Products Company
of Pennsylvania
Mertztown Pennsylvania

Tegul- MINERALEAD

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Meters and Recorders

Be Sure To Demand

•ACCURACY •RELIABILITY
•SOUND ENGINEERING
•MODERN APPEARANCE

Regardless of whether your problem calls for the use of a Venturi Tube, Weir, or Flume, you can depend on Bailey Meter Company to design and construct both the primary element and the register for maximum accuracy.

A vast amount of experience gained from thousands of installations of metering equipment, together with extensive experimental work in our own hydraulic laboratory and in the laboratories of the Ohio State University, Cornell University, Case School of Applied Science and other institutions, is back of every Bailey Primary Element.

The reliability of Bailey Meters and Recorders is attested to by the fact that thousands of dollars worth of steam and water are sold monthly and billed solely on the basis of readings from Bailey Meters.

No small share of the accuracy and reliability of Bailey Meters is due to the conservative engineering policy of the Company. New ideas and designs are not offered for sale until they have been thoroughly tested both in the laboratory and in actual service.

Bailey Meters, Recorders and Controllers present a thoroughly modern yet conservative appearance.

Write for your copy of Bulletins No. 301 and 302, describing Bailey Fluid Meters for steam, liquids, gases, sewage, sludge, and compressed air.

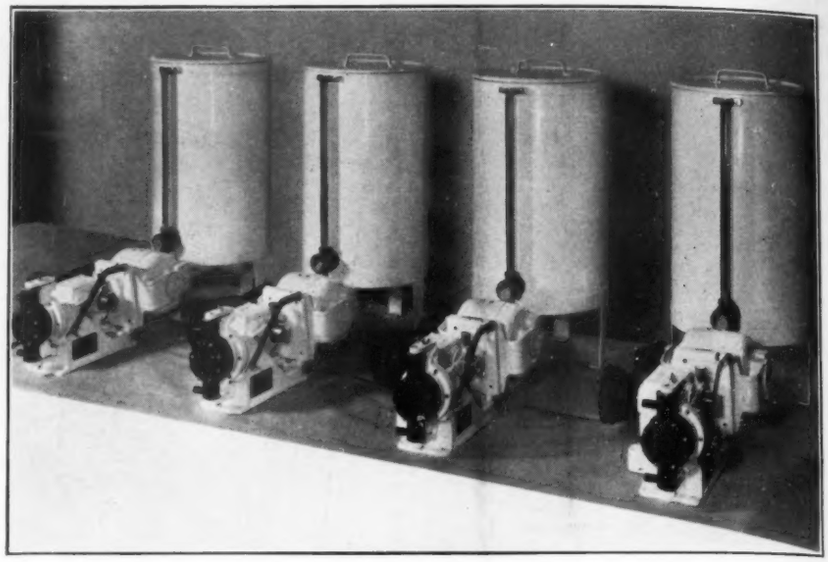
MU-16

BAILEY METER • COMPANY •

1072 Ivanhoe Road, Cleveland, Ohio

BAILEY METER COMPANY LTD., MONTREAL

WITH THE MANUFACTURERS



A Royal Job

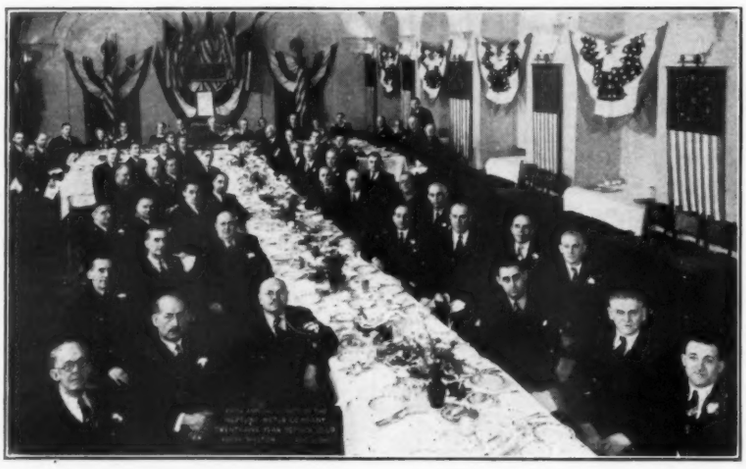
• %Proportioneers% Inc. of Providence shipped over a nice Christmas present to King Farouk of Egypt in the form of the four water purification units here pictured.

These two "Chlor-O-Feeders" and two "Amm-O-Feeders" are to be installed on the Royal Yacht "Nisr," which will henceforth draw water from the muddy Nile for Kingly use. The complete plant includes two gravity filters 24½" each in diameter, coagulation facilities, and the chloramination equipment pictured. The output will be 10 g.p.m. per unit.

Apparently this equipment was specified "Royal" because all bolts, nuts and hardware are in chromium finish and the paint used is of "special exhibition white," with black enamel trim.

Kipling was seemingly no prophet when he wrote the lines "East is East and West is West, but ne'er the twain shall meet." Interestingly enough, this equipment was sold through a British agency—The Jewell Filter Co., Ltd.

Neptune's 25-Year Service Club Holds Annual Dinner



• The initiation of four new members marked the fifth annual dinner of the 25-Year Service Club of Neptune Meter Co., held December 6th, in New York. As its name implies, the club is composed of veteran Neptune executives and employees who travel from all parts of the country for a yearly gathering at New York City headquarters. "Jim" Barker, of Pacific Coast fame, is president; A. B. Ricketts, secretary.

"I - knew - him - when" reminiscences were inspired by the ceremonial appearances and official Club acceptance of an engraved plaque, bearing the names of sixty-five present and the twelve deceased members, together with the dates upon which they had joined Neptune.

Virtually the entire eligible membership turned out—including members from certain distant territories, who before had been unable to attend the annual event.

J-M Men Answer Call to Duty

• J. H. P. Hughart, Johns-Manville Transite Pipe Manager for the Chicago area, has resigned his position to rejoin the U. S. Navy as Lieutenant Commander for the duration of the present emergency. V. C. Wyle, junior salesman in Northern Indiana for Johns-Manville, has also accepted active duty in the Navy with the rank of Ensign. To fill the position left by Mr. Hughart, Johns-Manville has selected L. P. Lessard who, from many years experience, is familiar with the problems of water works in the Chicago district.

In addition to this change new positions have been created to handle the increasing sales of Johns-Manville Transite Pipe in the territory. The men who will fill these positions are: D. A. Decker, formerly chief engineer of the Concrete Pipe Association, who will handle the sale of Transite Pipe in Northern Illinois; Gilbert Smith, formerly associated with Conseor, Townsend and Quinlan, Chicago consulting engineers, who will be in charge of Transite Pipe sales in Northern Indiana; and Verne Coulson, formerly pipe installation instructor for the Chicago district, who will take charge of Transite Pipe sales for Eastern Wisconsin.

TAPAX

The ORIGINAL and FINEST....

Manhole Cushion U. S. Pat. No. 2,050,050 offers you the simplest solution for noisy, rattling covers. Easy to install. Lasting — Economical.

Write for story of Tapax and Trial Offer.

TAPAX MFG. CO., INC.
MAMARONECK NEW YORK

WILL SACRIFICE

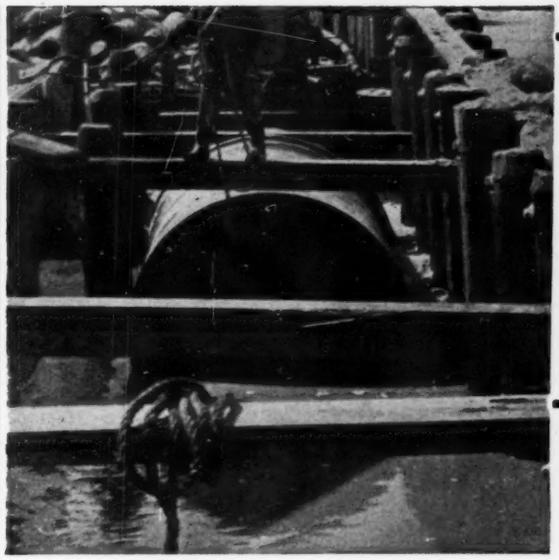
This standard Trenching Machine to liquidate stock. Digs 22" trench to depth of 13'. Powered by Waukesha 55 h.p. gas engine. Can ship in 10 days. An exceptional value at only $3,750. Write Box No. 120, Water Works and Sewerage, 330 South Wells St., Chicago, Ill.

SALESMEN WANTED

or Manufacturers' Representative calling on Waterworks & Sewerage Superintendents and Engineers, to handle water and weather proofing products or represent as a side-line, our complete structural waterproofing service. Address American Fluresit Company, Cincinnati, Ohio.

Situation Wanted

CHEMICAL ENGINEER—with eight (8) years' experience in waste treatment and water treatment is looking for a position. Address "W. T.," % Water Works & Sewerage, 155 East 44th St., New York, N. Y.



84" pipe—Spring Lake, N. J.

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FLEXIBLE JOINT PIPE
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Large stock enables us to make prompt shipments.

CAST IRON PIPE

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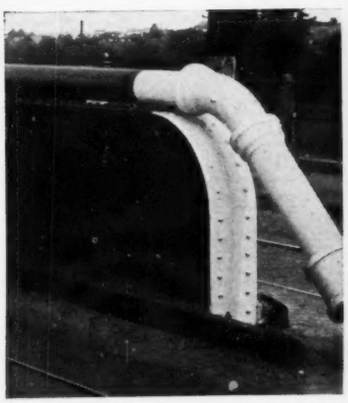

LEADITE has been used with satisfactory results . . . In addition to general cast iron bell and spigot water main installations . . . for over 35 years.

THE LEADITE COMPANY
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No Caulking

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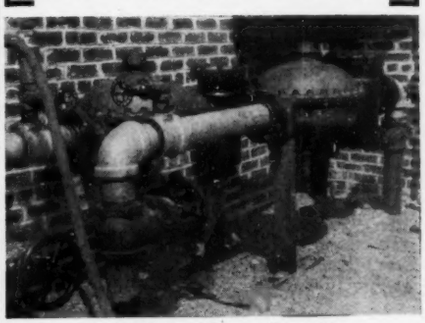
PITTSBURGH LARGE CAPACITY METERS



Installation of Large Capacity Arctic-Tropic Disc Meters

In any industrial plant the amount of water used runs into surprisingly large figures. Unless this consumption is accurately metered, there will be an appreciable loss in revenue from this important type of consumer.

Pittsburgh Large Capacity Meters are made in Disc, Current and Compound types. All are accurate and thoroughly dependable. From this complete line the proper type and size for any particular job may be selected.

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Dorrco Doings in 1940

Looking back at the rising tempo of world catastrophe in 1940, in the future some may wonder how it was that business concerns could go along with the day's work and record, as if they were important, the incidents of their business year. Our own organization, touching as it does in some small way almost every area in the world, cannot but be acutely sensitive to what is happening over the face of the earth today.

What has seemed to be the infinite promise of improvement in human well-being through the peaceful constructive service of the engineer is frustrated by the lag in the ability of the human animal to apply to human relations similar constructive principles of truth and toil and service and working together; and instead, for the time being, our profession itself becomes a minister of destruction. It would be insupportable but for the conviction that there is no other course to take to preserve out of the wreck what must be preserved at any cost.

Meanwhile the day's work must go on. It makes for sanity to take account of the ordinary constructive things we are all engaged in. It is with no lack of sense of proportion, then, that I review, as usual, some of our own doings during the year.

WESTPORT MILL

Investigations in the production of defense materials—magnesium, aluminum, manganese, chromium, nickel, etc.—have claimed a large part of our attention this year. Fundamental classification studies are aiming at higher efficiencies and cleaner sands. Investigations of optimum feeding and overflowing conditions in sedimentation units promise a more effective utilization of tank volume.

7 ACRES OF THICKENERS FOR MORENCI

At Phelps Dodge's new 25,000 ton concentrator at Morenci, Arizona, 300 foot thickeners will dewater tailings and torq thickeners will thicken flotation concentrates. Few, if any, metallurgical plants exceed this one in installed thickener area.

LOW COST CEMENT GRINDING

3 to 3.25 K.W.H. per barrel of finished cement for raw grinding is the all time low set this year at a new 12,000 barrel cement mill in California. Dorr Classifiers and bowl classifiers close the primary and secondary grinding circuits and are followed by Dorr thickeners and slurry mixers.

NEW YORK'S FIFTH SEWAGE PLANT

The 65 M.G.D. plant at Jamaica Bay, now being completed in New York City's sanitation program, will include our clarifiers as did the Wards Island and Coney Island units. Eight 120 foot clarifiers will be used for final sedimentation.

INDUSTRIAL WATER PURIFICATION

The new smokeless powder plant of Hercules Powder, near Radford, Pa. is to purify 25 million gallons of water a day for process purposes. We are supplying two essential steps; mechanical flocculators, and two large clarifiers.

LIGHT METALS

Increased demand has brought us much work. One plant using the Bayer Process will employ Dorr equipment for closed circuit grinding and for red and white mud handling. Increasing plant capacity for both alumina and magnesia production has required more of our equipment, with new modifications in some cases.

SUGAR

A closer union with Petree & Dorr, our cane sugar affiliate, has resulted in our transferring to them our beet sugar processes and equipment, thus consolidating our sugar activities.

CAMP SANITATION

We have been busy supplying sewage and water treatment for a score or more army camps, naval bases and military air fields, all in connection with the National Defense Program. Our Biofiltration System and Clarigester are ideal for the special conditions prevailing.

BIOFILTRATION

Fifteen months ago we announced our Biofiltration System, utilizing high rate trickling filters in combination with recirculation of effluent. Results comparable with more expensive types of treatment have been demonstrated and we now have 41 installations in operation or under contract.

NEW IDEAS

Three entirely new units made their debuts this year—the Dorrco Slaker, combining lime slaking and grit removal; the Dorrco Hydro-Treator, a self-contained water purification unit; and the Dorrco V Type Pump, with provision for changing stroke while running.

A continuous centrifugal has been applied to the removal of minus 5 micron slime from flotation feed. We have acquired a hydroseparation process for cleaning flotation concentrates.

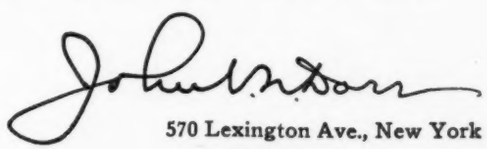
ABROAD

Cerro de Pasco in Peru has ordered a large number of classifiers and thickeners for a new mill and the gold activity in Nicaragua has led to one new entirely Dorr-equipped cyanide mill and substantial additions to others. The first Dorr sewage installation in the Philippines was made in Manila and the first Dorr Recausticizing System in South America at Cellulose Argentine.

In warring Europe our associated companies are carrying on independently in their respective spheres. Some of the staff formerly functioning largely in plant design there are now with us in New York.

This year has brought me a trip to Puerto Rico, motoring through the Southwest, as well as a short stay in Newfoundland and a look at the Black Hills and the Michigan copper country.

On behalf of all of us, I extend the Season's Greetings to our clients and friends in so many lines of industrial endeavor.



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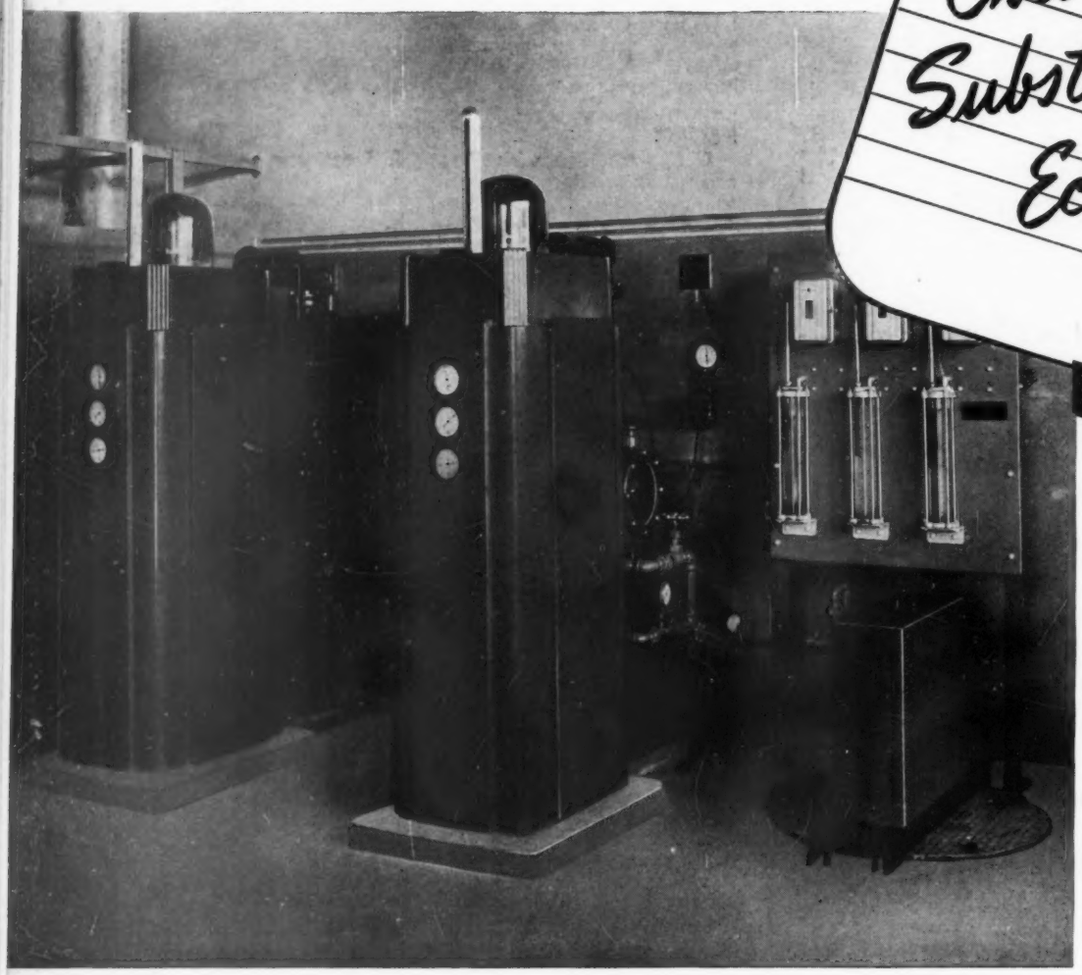
DORRCO

Programmed Chlorination effects Substantial Chlorine Economies



Two 100 lb. per day Visible Vacuum Chlorinators —one program controlled for prechlorination of raw sewage— one automatically proportioning chlorine to flow of final effluent, at Veterans' Home of California, Yountville, Calif.

Designed to provide chlorination, both for the prevention of obnoxious odors and for final effluent disinfection, this W&T Chlorinator installation incorporates two interesting control principles which effect substantial chlorine economies.

Odor prevention depends upon adequate chlorination of the raw sewage. This raw sewage has a changing chlorine demand due not only to flow variations but also to changes in the character—strength—of the sewage and to temperature influences. All of these variations are the product of a reasonably consistent daily time cycle.

Plant studies indicated four distinct steps in this time cycle and time control programming devices were installed to automatically vary the rate of feed from the W&T Visible Vacuum Chlorinator to conform to these chlorine demand changes.

Similar programmed installations have reduced the daily chlorine consumption by as much as 50 per cent.

Disinfection of the stabilized effluent from the bio-filters presents no problem of changing chlorine demand but does require constant automatic adjustment of the applied chlorine to maintain the predetermined chlorine dosage proportional to the varying flows. A W&T Automatic Visible Vacuum Chlorinator, weir head controlled, handles this phase of the program.

Such chlorinator installations as this are the product of specialized knowledge acquired over twenty-seven years of experience—with more than 20,000 chlorinator installations. You cannot do better than trust your chlorination problem to W&T equipment backed by W&T trained personnel.

Technical publication 473 "Problems and Progress in Sewage Chlorination" is yours for the asking. Send for your copy today.

"The Only Safe Sewage is Sterilized Sewage"

WALLACE & TIERNAN CO., INC.

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